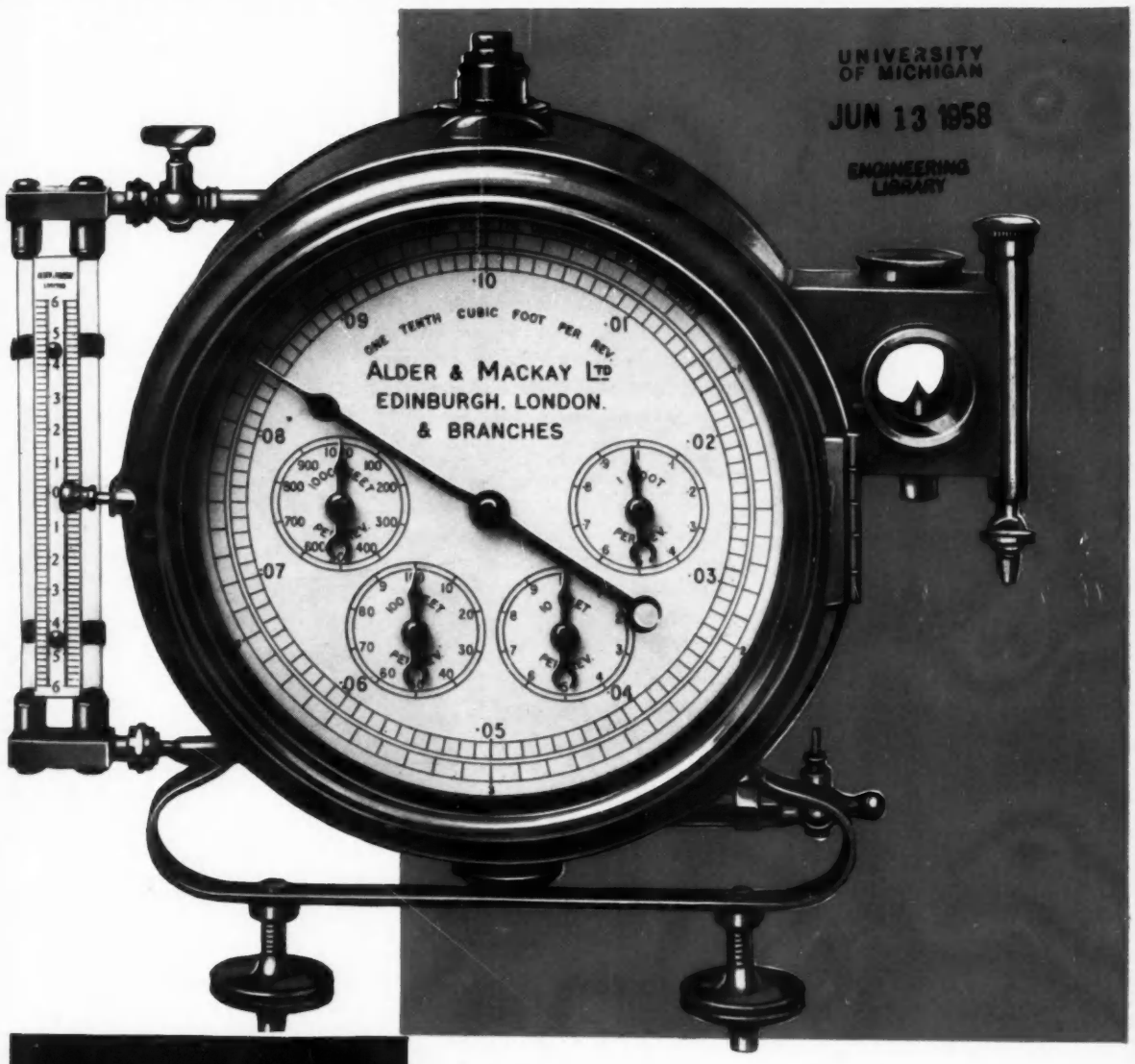
Gas Journal

VOL. 294. 110th YEAR. LONDON, MAY 28, 1958 No 4950 PRICE 1/6

UNIVERSITY OF MICHIGAN
JUN 13 1958
ENGINEERING LIBRARY



TEST METERS

The performance and accuracy of the wet test meter sets the performance of all commercial meters.

The A & M 0·1 c.ft. Wet Leakage Meter is accurate to ±0·1%—and is one of a number of Test Meters ranging from 5 c.ft. per rev. down to 1/50th c.ft. per rev. and the one-litre (dismemberable).

Models which are so sensitive that they will register within ±0·02% over a complete revolution.

Instruments that will measure a sigh!

U·G·I GROUP

Alder & Mackay Ltd.

New Grange Works, Edinburgh, 11

COKE RECOVERY FROM GENERATOR OR PAN ASH

Completed 1956

CLAPHAM INSTALLATIONS

Manufacturers of

Condensing Plant
Tar Extractors
Washers (Pumpless Patent)
Oxide Purification Plant
Patent Boxless Purifiers
Liquid Purification Plant
Mechanical Handling Plant
Iron Castings
Mild Steel Fabrications

Coke and Pan Ash Washers
Purifier Control Valves
Gas Pre-Heaters
Briquetting Plants
Refractory Brick Making Plant
Special Pipes and Connections in cast iron and Steel
Welded Mild Steel Fabrications

CLAPHAM BROS. LIMITED

Makers of Gas Works Equipment since 1837.

KEIGHLEY, YORKS. Tel: 2787-8. Grams: "Clapham Bros., Keighley."

FOR THE CHEMICAL INDUSTRY
FOR THE GAS INDUSTRY
FOR ALL INDUSTRIAL USES WHERE A RELIABLE FORM OF BLOWING OR BOOSTING IS REQUIRED

V50 BOOSTERS BLOWERS

EX-STOCK
(BARE END SHAFT)

DUTIES

600 C.F.M. AT 13" W.G. TO 1000 C.F.M. AT 9" W.G. } ON GAS

600 C.F.M. AT 26" W.G. 1000 C.F.M. AT 18" W.G. } ON AIR

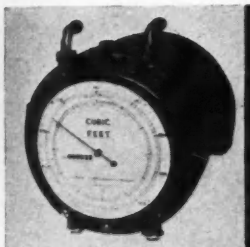
ASK FOR PUBLICATION No. P/79

THE BRYAN DONKIN COMPANY LIMITED
CHESTERFIELD — LONDON

Backed by

150 years' experience

in the measuring of gases

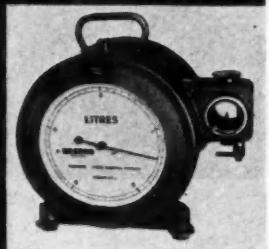


MODEL A

Laboratory Meter with helical drum. 1/50th cu. ft. per rev., 20 cu. ft. per hour (or ½ litre per rev., 500 litres per hour).

MODEL B

Portable Copper Cased Test Meter. 1/50th cu. ft. per rev., 10 cu. ft. per hour (or ½ litre per rev., 250 litres per hour).



MODEL E40

Test Meter with stainless steel case and drum. 1/10th cu. ft. per rev., 40 cu. ft. per hour (or 2½ litres per rev., 1000 litres per hour).

These laboratory meters set up **new standards of accuracy.** Interior accessible for cleaning. Easily levelled.

PARKINSON COWAN
INDUSTRIAL PRODUCTS

Full particulars of these and other models gladly sent on application to

COTTAGE LANE, CITY ROAD, LONDON E.C.1. Tel. Clerkenwell 1766/7

Gas Journal

VOL. 294 NO. 4950 28 May, 1958

110TH YEAR

MANAGING DIRECTOR: Clifford A. King

EDITOR: Geoffrey W. Battison

ASSISTANT EDITOR: Colin J. Godbold

TECHNICAL EDITOR: Charles J. P. de Winton, T.D., M.A., M.Inst. Gas E., M. Inst. F.

Published by Walter King Limited,
11, Bolt Court, Fleet St., London, E.C.4

Telephone: FLEet Street 2236-7 Telegrams: Gasking, Fleet.

CONTENTS

EDITORIAL COMMENT

New Era for Scottish Gas 475
Work Study : Maintenance 476

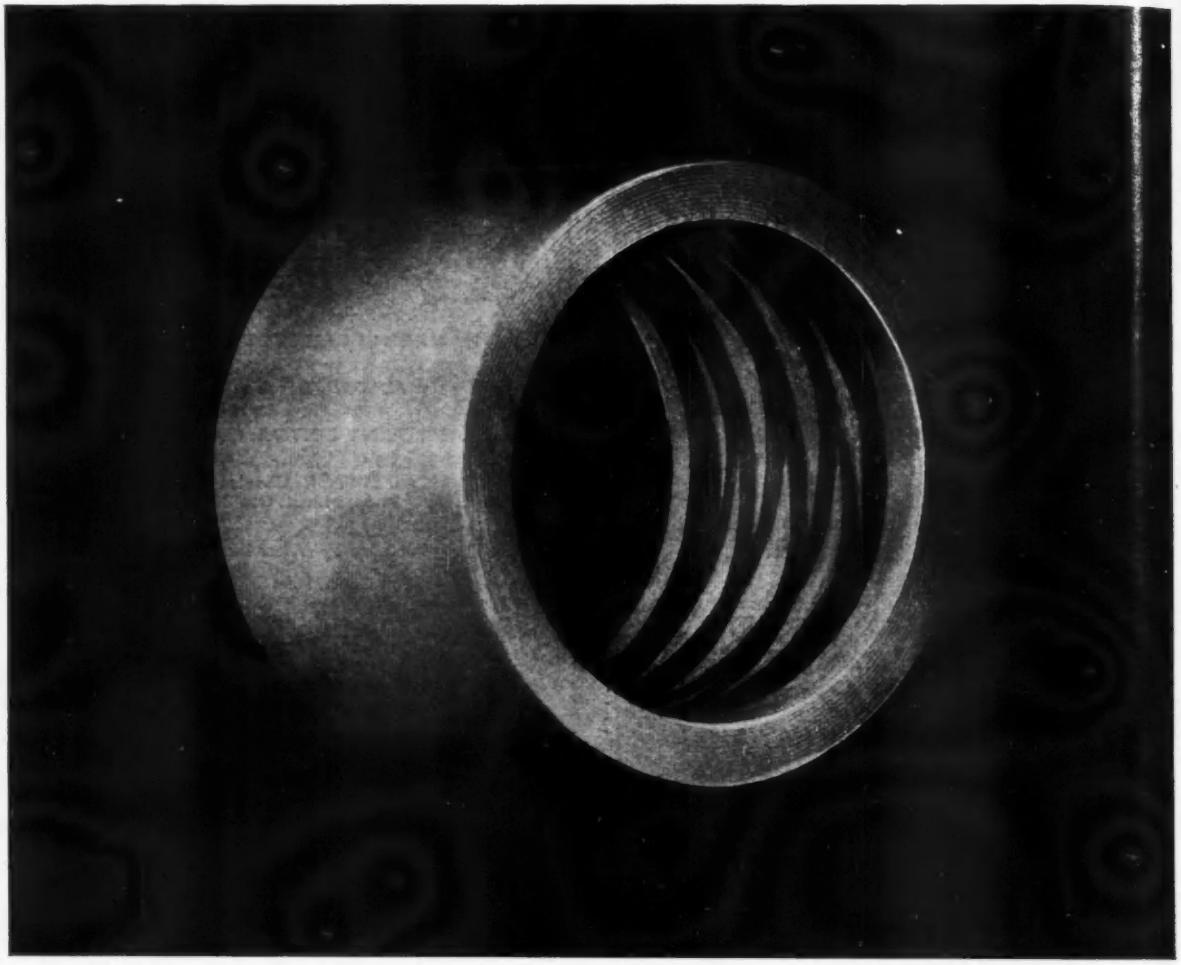
NEWS OF CURRENT EVENTS

Personal 477
Obituary 477
Diary 477
E.M.G.B. Reorganises Production Control 477
B.G.S.A. Annual Conference 488
The Institution Afloat—and Aground 479
Youth in the Kitchen Final 480
Natural Gas is Raw Material and Fuel in Synthetic Rubber Plant 486
Company Secures £3.75 Mill. Coke Oven Contract 486
Gas Appliance Sales Rise in N.W.G.B. Area 486
New Transistor Firm Formed 486

TECHNICAL RECORD

One Year's Work—Reorganisation and New Projects in the South East. By A. E. Haffner 481
Towards Preventive Maintenance. By W. M. Johnston .. 491
Discussion on "Work Study : Three Years' Progress at Edinburgh." By David Beavis 497

PUBLISHERS' NOTICE, SEE PAGE 503



There is more in gas metering than meets the eye

This is the journal of a self-lubricating bearing used in Parkinson Cowan industrial meters.

The phosphor bronze journals run on hard-wearing stainless steel pivots in all bearings. The spiral grooves inside the journals are packed with bonded graphite which provides continuous lubrication of the bearings throughout the long life of the meter. No other bearing lubrication is required.

It is the thorough design, meticulous manufacture and careful assembly of each component that has made Parkinson Cowan meters so famous for long life with consistent accuracy.

PARKINSON COWAN GAS METERS

Terminal House, 52 Grosvenor Gardens, London, S.W.1. SLOane 0111

Gas Journal

VOLUME 294. No. 4950. MAY 28, 1958. 110th YEAR

A New Era for Scottish Gas

THE silver-turreted retort house at Largs has a fairy-tale quality—a castle in which any self-respecting princess would gladly be imprisoned. In a challenging position immediately across the road from the works crouches the wicked robber's lair in the shape of the South of Scotland's electricity service centre. It was hardly surprising, therefore, that this pantomime quality was imparted to the Scottish Gas Board's second staff conference held there last week, for while the Fairy Queen—if Mr. Sydney Smith will accept the part—held sway on Thursday the scene was bathed in sunshine as bright as anything Drury Lane (or the King's, Glasgow) could manufacture, while the presence at the meeting on Friday of an electricity board chief was the signal for the howling wind and lashing rain usually associated with the demon king!

In the conference, however, there was no place for make-believe. For a day and a half of absorbing interest—and we do not use the phrase lightly—facts were looked squarely in the eye. That the conference was a substantial improvement on its predecessor is beyond question, and since this was entirely contrary to our expectations, based on a preliminary examination of certain of the papers, it is of interest to seek the reason for this superiority. Last year, it may be remembered, proceedings covered the fields of production, sales, finance, and so on. A glance at this year's programme suggested that the Board had already played all the aces in the pack. Why then was this conference more satisfactory in every way than last year's?

In our view there were two reasons: The fact that use was made of two outstanding speakers from fields far removed from gas, and also the fact that at last year's conference the new policy and approach of the Board was, so to speak, on trial; this year there was an overwhelming measure of acceptance. This transition was readily apparent to the spectator and, to our mind, it betokened something of a triumph for the new regime.

The conference began, as indeed all such conferences should, with a statement by the Chairman on the results of the year just past, from which it seems the Board has emerged with a small surplus. The chairman described the achievements in his usual painstaking manner; we even learned, for example, that 150,142 taps were adjusted. In terms of internal progress the year was eventful: One universal tariff—and a very favourable one too—now surplants the 24 which obtained before (although as in other boards it has been found that this needs to be sold more forcefully to the consumer); more mains have been laid; at least as much gas sold; therms per ton of coal carbonised went up by 0.9 of a therm; savings have been achieved as a result of bulk buying; substantial progress was made towards safety, particularly in the case of elderly people; and instructional facilities were extended. On the other hand, appliance sales, although slightly up on the previous year, tended to increase in the wrong places—in other words, cooker and water heater sales were down—and coke sales were disappointing. Overshadowing all, however, was the Board's decision to proceed with the erection of the Lurgi plant at Westfield, which not only holds the promise of cheaper gas but also, to our mind, scope for a tremendous public relations campaign in direct conflict with the patriotic appeal exerted by the hydro-electric board.

Of the outside speakers, Admiral Sir Denis Boyd gave his well-rehearsed, superbly delivered and wholly disarming talk on 'Leadership,' while Professor T. E. Chester, of the Department of Social Administration, University of Manchester, whom we found to be a most rewarding, if somewhat elusive, speaker, outlined 'Management Problems in Large-scale Organisations.' Occurring as they did in that order, Boyd and then Chester, it might have been thought logical to follow with the paper on 'Operational Research,' by Messrs. H. R. Hart and H. A. Burns since this somewhat advanced explanation of a new tool of management would have been accepted more readily after a certain amount of softening up. Instead the paper preceded the other addresses and one sensed a certain audience resistance to this new 'new-fangled' method, the description of which, although according to the authors much simplified, struck many as unnecessarily complicated. When the Board's Chief Financial Officer confessed that he found himself 'rather bamboozled' by the mathematics in the paper one felt somewhat com-

forted, and there was general agreement with Mr. A. M. Donnet, one of the several trade union representatives who made very worthwhile contributions to the conference, when he remarked that we were already sickened by the terminology used in work study. It was he, by the way, who suggested that the existing six-man O. R. Team might be augmented by a medical psychologist—a suggestion which was greeted with smiles by the audience but eager nods of assent by the authors. On the whole the discussion was surprisingly good, and mercifully there was no lack of light relief. Here we must mention Mr. W. Nicol Baird who, possibly feeling that he had been outsmarted by the authors, got his own back by out-talking them. His defence of the open fire on the grounds that it came in handy for spitting into was capped by the Chairman's suggestion that a free spittoon might be provided with every gas fire sold! We were left with the impression that operational research is playing a valuable part in improving efficiency in the Scottish Gas Board—as indeed it is in other industries—but that owing to the flavour of 'holy cow' attaching to the paper this was not an entirely successful attempt at selling the idea to the rank and file.

The remaining item on the programme was a trilogy on 'Health, Safety and Welfare,' by Dr. D. G. Waddell, the Board's Medical Officer, T. B. Livingstone, Divisional Production Engineer at Perth, and B. Preston, Welfare and Training Officer at Edinburgh. This proved to be a major success with an admirable discussion.

However, there were two other features of the conference worthy of mention. One was the presentation by Sir Harold Smith of certificates for 40 years' service in the gas industry to the Chairman, who has reached his present position via Bradford, Birkenhead, Dunfermline, Bristol, Paisley, Romford and the East Midlands Board, and Mr. D. D. Melvin, Board Member, whose success story, embracing Glasgow, Lanark, and Edinburgh, has kept firmly north of the Border. The other point concerned a remark made by Sir Harold during the conference which seemed to us of some significance. He said that the level of the sales side of the industry was not up to that of the appliance manufacturers and that the standard of discussion at the Sales and Service Conference at Harrogate was right back at pre-war level. 'We have a completely new industry building up on the production side,' said Sir Harold, 'but on the sales side we are back at the stage of the stopped-end, hand-fired horizontal retort.' We think he is quite right, but we also think that one of the reasons for this is that while the industry has been breeding production engineers of a high calibre, it has failed to invest the necessary money in building up a high-grade sales force. In the circumstances it is a little unfair for the engineer, who in the past has attached little importance to sales, to blame the salesman for his shortcomings.

We hope we have said enough to indicate that this second staff conference in Scotland was an interesting and rewarding affair; next week we shall be publishing a full report. In our comments on last year's conference we referred to Mr. Sydney Smith as a surgeon, while this year we have spoken of him as a fairy queen. The two rôles would appear to have little in common but it may be significant that the object of both characters is to improve matters which seem incapable of solution if left to themselves. We do not think any fair-minded observer would deny that he is doing a great deal of good for the Scottish gas industry and that he is achieving this in spite of great opposition. In the past some of that opposition has come from his own people, but if our assessment of the situation is correct there is a growing acceptance of the new ideas and a realisation that only through them can the industry continue to hold its own. Mr. Smith is quite confident: 'The road ahead for us is not into the setting sun, but towards the new dawn —a new era of prosperity.'

Work Study: Maintenance

THE importance of maintenance to plant and machinery cannot be over emphasised and from time to time papers have been published in this journal which have shown how techniques have advanced since the war. Its importance becomes all the greater as more costly plant is installed and more complicated machinery and instrumentation become commonplace on the industrial scene. As the cost of labour rises, so the need for labour-saving devices becomes greater. As the demand for products made to a tighter standard specification increases, so does the need become more apparent for automatic devices which will correct operating conditions.

Maintenance, even when highly organised preventive maintenance has been adopted, has recently figured in gas production costs. It is imperative that, in the light of this factor, the necessary repairs and overhauls are done with the least expenditure of skilled men's time and the minimum of capital tied up in spares.

The latter can be saved by the standardisation of plant and machinery and by keeping as few spares as possible in a properly-organised stores. Streamlining of the labour force must be on the basis that each member of it has a part to play according to his position, his skill, and training. Presumably, the foreman is the best craftsman as well as the best available leader. Work requiring less skill and personality should be relegated to others. In the past, perhaps, organisation of maintenance men has been somewhat too easy going and, although this does not reflect in any way on the conscientiousness of the foreman or chargehand, it does show the need for management to apply modern methods of control over their activities. In the past, the proper setting out of tasks has been applied to the district only, principally because much of this work was rechargeable to the public, and the use of job sheets in the works was considered impossible. Such views, however, seem to have been proved wrong, and a paper we publish this week by Mr. W. M. Johnston, Assistant Works Engineer at Luton (p. 491) offers some most interesting ideas as to how such shortcomings in the organisation of maintenance gangs may be remedied and how work study may be applied to this aspect.

He makes the point that by 'functionalism,' or the use of men correctly trained for their particular jobs (coupled with the co-operation of other services) time can be saved on repair jobs, and expensive skilled labour kept more usefully employed. Measurement of efficient working by expressing it as the ratio between cost of labour and cost of materials used on a job gives an accurate assessment of how much useful work can be expected of any maintenance gang.

Personal Notes

MR. A. R. DAVIS, F.I.M.T.A., has been appointed by the Gas Council to succeed Mr. W. Bailey as Chief Accountant when the latter becomes Secretary of the Council at the end of September. Mr. Davis is at present Chief Accountant of the West Midlands Gas Board, an appointment which he has held since 1949.

MISS MAYWEN GODBY, who is representing the Women's Gas Federation at the ninth Congress of Home Economists in Maryland, U.S.A., in July, has been chosen by the United Kingdom Federation, the body under whose auspices the British party is attending the Congress, as one of the two official delegates. Miss Godby is Chairman of the National Executive of the British Association of Home Economists.

MR. FRANK BRINSLEY is retiring from the post of Radiation Technical Service Manager. Mr. Brinsley joined the staff of Radiation, Ltd., in 1927, as Official Lecturer, and this function built up in due course to the Technical Service Department of which Mr. Brinsley has been Manager from its inception. During this period he has engaged in many activities in the gas industry, including membership of the Education Committee of the I.G.E. from October, 1950, until the present date. His activities under the ægis of this Committee in giving Christmas lectures to young people are well known.

Obituary

MR. T. W. AIKEN, Sales Director, Bryan Donkin Co., Ltd., has died, aged 56.

MAJOR FRANK H. BRAMWELL, who joined the Board of Directors of the Power-Gas Corporation, Ltd., and Ashmore, Benson, Pease & Co., Ltd., in 1949, died earlier this month. He had spent most of his working life with Imperial Chemical Industries Ltd., the latter part as Chief Engineer of their general chemicals division. Up to his death he took an active interest in the affairs of civil, mechanical, electrical and chemical engineering institutions.

Diary

May 30. — LONDON AND SOUTHERN JUNIORS: Meyerstein Theatre, Westminster Hospital School of Medicine, Horseferry Road, London, S.W.1. 56th Annual Business Meeting. 6.30 p.m.

May 31.—EAST OF SCOTLAND JUNIORS: Dunfermline. Annual General Meeting.

May 31.—SCOTTISH WESTERN JUNIORS: Visit to Paisley gasworks.

June 3.—SOUTH EASTERN G.C.C.: Caxton Hall, London, S.W.1. 11 a.m.

June 4.—WALES AND MON. JUNIORS (NORTH WALES SECTION): 'Gas, a Refined Fuel,' by D. J. Turner. The Dobbie Lecture Hall, Deiniol Road, Bangor. 2.30 p.m.

June 4.—SOUTHERN G.C.C.: Town Hall, Bournemouth. 11 a.m.

June 4.—SCOTTISH G.C.C.: 9, George Square, Glasgow. 11.30 a.m.

June 5. — SOUTH WESTERN G.C.C.: Taunton. 11 a.m.

June 7.—EAST OF SCOTLAND JUNIORS: Golf Outing, Falkirk.

E.M.G.B. Reorganises Production Control

AT vesting date the East Midlands Gas Board took over 117 gasworks. Today there are 23 gas manufacturing works and 11 works where producer gas or carburetted water gas is made. In addition, there are 19 coke oven plants supplying gas to the area.

Interconnecting trunk mains, notably the backbone main, have been laid throughout the area. The Notts. and Derby and Leicester and Northants. Divisions are fully integrated as is almost the whole of the Sheffield and Rotherham Division.

Mr. F. G. Pyper.

In due course, by the completion of the one remaining link in the backbone main between Sheffield and Chesterfield, the Sheffield and Rotherham Division will be integrated for supply purposes with the Notts. and Derby and Leicester and Northants. Divisions.

In these circumstances the Board have been reviewing their production and engineering organisation and have decided that the production of gas, the reception of bought gas, and the bulk distribution of gas (excluding the construction and maintenance of the distribution system) and associated industrial relations matters should be placed under the direct control of a chief officer designated Chief Engineer and Production Controller.

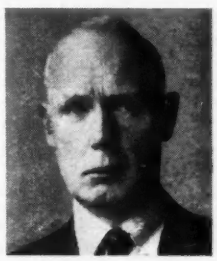
Mr. C. E. Mills.

The reorganisation will be effected in two main stages: Stage 1 will consist of the appointment of the initial senior engineering staff and the provision of accommodation necessary to enable the Chief Engineer and Production Controller to undertake control of production and planning in the Notts. and Derby and Leicester and Northants. Divisions on September 1, 1958. Stage II will consist of the extension of control to the Sheffield and Rotherham Division not later than September 1, 1959.

Mr. A. W. Elliott.

The title of Divisional Engineer in the Notts. and Derby and Leicester and Northants' Divisions will cease to exist at Stage I and instead there will be a Production Engineer (Southern); the title of Divisional Engineer, Sheffield and Rotherham, will cease to exist at Stage II and instead there will be a Production Engineer (Northern).

The following initial appointments have been made: Chief Engineer and Production Controller, Mr. F. G. Pyper, at present Chief Engineer; Assistant Chief Engineer and Production Controller, Mr. C. E. Mills, at present Divisional Engineer, Sheffield and Rotherham Division; Production Engineer (Southern), Mr. A. W. Elliott, at present Divisional Engineer, Notts. and Derby Division; Divisional Engineer, Sheffield and Rotherham, proposed Production Engineer (Northern) at Stage II, Mr. R. Hutchinson (at present Divisional Engineer, Leicester and Northants Division.



Mr. R. Hutchinson.

For the present no organisational change is proposed in the Lincolnshire Division, but in the longer term the new form of control will be extended to that Division.

This change relates only to the production and engineering function as defined in paragraph 2 above. All other Divisional departments and activities will remain under the control of the Divisional General Managers.

B.G.S.A. ANNUAL CONFERENCE

Disappointment Expressed with Results of Joint Consultation

ONE of the highlights of the annual conference of the British Gas Staff Association, held on May 9 and 10 at Weston-super-Mare, was the address by Mr. C. H. Chester, C.B.E., Chairman of the South Western Board.

Mr. Chester said the gas industry was well placed in the nation's fuel economy. Gas had no monopoly; in competition with other forms of fuel, its services must be efficient if it were not to lose custom. By greater efficiency in manufacture and distribution the industry had passed on to the consumer only a proportion of the increased costs which had arisen since vesting date. All employees had contributed to this.

Research policy of the industry was leading to even higher efficiency in production and use. There was a tremendous untapped market for room heating and water heating which could be largely satisfied by gas. Research would probably bring a sulphur-free, non-toxic, cheaper gas which could well lead to a resurgence of the gas industry.

A Great Future

All these developments gave an opportunity for participation by employees in the objectives of the Boards through joint consultation, though results so far were disappointing. The industry had a great future, and new manufacturing and other processes would bring increased efficiency and safer employment.

The Conference regretted the absence of the President, Mr. W. E. Webb, who is in hospital. The Deputy President, Mr. C. C. Holt, of York, who presided, read the President's Address, saying that while the industry was not without its detractors, there had been a high standard of achievement since nationalisation. Research had given the industry a choice of raw materials which should produce cheaper gas, and never before had such a fine service and wide choice of modern appliances been available.

One of the prime objects of the B.G.S.A. was to promote and foster good relations between employers and employees, and in the industry there was a fine spirit of co-operation and understanding. The B.G.S.A. had conducted a country wide enquiry into the working of joint consultation and while there was some disappointment in progress in some areas, the B.G.S.A. urged that through joint consultation every employee should be able to feel he belonged to the organisation and understood its purpose. The B.G.S.A. had played no mean part in obtaining a reduction of purchase tax on gas appliances.

Changes in the industry were inevitable, and much which had been customary and even traditional must be discarded; but we could look to the future with confidence.

The General Secretary, Mr. F. C. Henfrey-Smith, introducing the annual report said 1957 had not been spectacular in national negotiations for the staff of the industry. A salary increase had been obtained from May, 1957, but since then the cost of living had risen by nearly 4% and it had been necessary to table a further salary claim.

The Association believed the restoration of differentials to be a vital matter and that responsibilities, qualifications, etc., should be recognised more fully.

Members of the Association had not greeted with enthusiasm the establishment by the Minister of Power of a Committee to consider more co-operation between gas and electricity. The National Council of the Association was giving consideration to comments which it would submit to the Minister's Committee on this question.

On the introduction of electronic computers into offices, Mr. Henfrey-Smith said that if automation in industry enabled full peak production to be reached with a smaller labour force, the trade union movement must ensure that by shorter hours, earlier retirement, longer holidays, etc., work was spread fairly over the community so that all would benefit from increased leisure.

Mr. Henfrey-Smith concluded by saying that the gas industry might, in our lifetimes, eliminate solid fuel from domestic households. There might eventually be a national fuel policy in which the fuel load was balanced between gas and electricity, or the two fuel services might be fused.

The Association must keep a watchful eye on changes in the organisation of the fuel industries, and would willingly co-operate with all other interested bodies to ensure that the country had the best possible fuel service from its natural resources and that the staff of the industry continued to have satisfying and rewarding employment.

Mr. T. R. Robson, Financial Officer, presented the statement of accounts, and in secret session the members agreed to increase the subscription to 4s. a month for adult members from January 1, 1959.

The conference deprecated Government interference in agreements reached by properly constituted negotiating councils regarding wages and conditions of service of employees in the nationalised industries and service. The National Council was instructed to formulate and present to the major political parties the views of the Association on future organisation of the industry.

The Conference agreed to recommend to the Gas Council that domestic tariffs for gas be generally investigated with a view to the introduction nationally of an attractive two-part tariff, or other suitable form of charging.

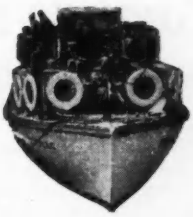
There was criticism on the progress of joint consultation, such criticism being directed mainly at members of management who appeared to do little to support it. The Conference urged that every effort should be made to reach an agreement to compensate redundant gas staffs after the Gas (Compensation) Regulations ceased to operate in April, 1959.

The Conference rejected suggestions that its size should be reduced or that it should, in future, be biennial.

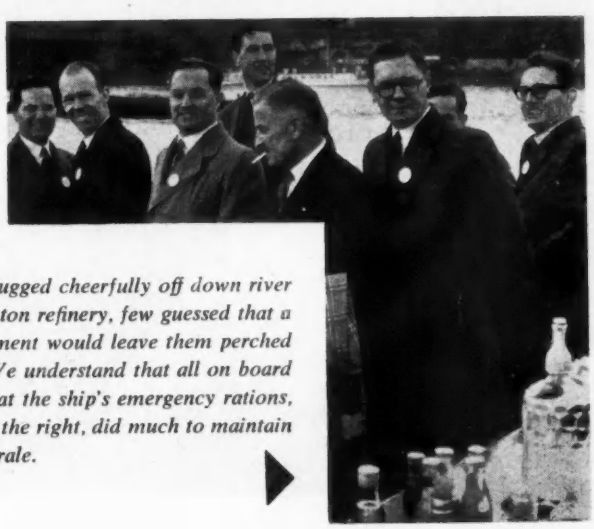
Mr. W. E. Webb was re-elected President and Mr. C. C. Holt Deputy President.

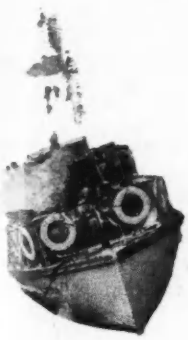
Mr. C. H. Chester, C.B.E., Chairman of the South Western Gas Board, shares a joke with Mr. F. C. Henfrey-Smith, B.G.S.A. General Secretary, and Mr. K. E. Stringer, South Western Gas Board Personnel Manager, during the B.G.S.A. Conference.

The Institution Afloat . . .



. . . and Aground !





When the good ship Zodiac chugged cheerfully off down river on a 95th A.G.M. visit to Coryton refinery, few guessed that a gust of wind at the wrong moment would leave them perched on a mudbank for an hour. We understand that all on board exhibited great courage and that the ship's emergency rations, glimpsed in the photograph on the right, did much to maintain morale.

Youth in the Kitchen ... ... the Final Fling

PRINCESS ALEXANDRA PRESENTS PRIZES AT THE CAFE ROYAL

YOUTH in the Kitchen had its final fling at the Café Royal on May 14 when Princess Alexandra of Kent presented the prizes. The title of top teenage cook in Britain went to 17-year-old Roy Wilkinson, of Stretford, who is in his second year's training for the hotel and catering industry at the Domestic and Trades' College, Manchester. Fourteen-year-old Wendy Day, of Colchester, came second, and 19-year-old Peter McVey, of Croydon, third.

All the young competitors put up a fine show under harrowing conditions and it was unfortunate that Mr. John Fuller, spokesman for the judges, should have revealed that in assessing competitors' efforts allowances were made for this and that—thereby depriving the participants of the satisfaction of knowing that it was a straight fight.

Princess Alexandra was not only a perfect choice for prize giver by virtue of her age and appearance; she exhibited a charm and sense of real personal interest and enjoyment that communicated itself to everyone present. Having toured the kitchens and had a word with each competitor, she mounted the dais and listened to Sir Harold Smith's speech of welcome with an enviable composure. In the overheated crowd of people who pressed around the stage programmes flapped in a vain attempt to stir up some latent pocket of oxygen, and the 12 competitors waited anxiously for the results to be declared. The Princess confessed to being a poor hand at cooking, a fact which, she said, filled her with admiration for the efforts of those taking part in the contest.

The names of the winners were announced, the prizes were presented, and then it was all over—the competition which had started in the areas with 35,000 entrants and had gradually whittled the competitors down to 12 and, finally, to four. This was the conclusion of months of work and planning by the area boards and the Gas Council, and of a publicity campaign which had ranged from local papers to TV.

It was the end, too, of a gruelling few hours during which chief home service advisers had fussed around their young champions, wondering if their careful advice would be remembered, publicity men had kept a wary eye on the arrangements, commercial managers had made half-hearted bets, and appliance manufacturers had wondered whether it was all worth it. Certainly Mains must have thought so for the cooker, water heater and refrigerator used by the winner all came from their famous stable.

Left, the 12 finalists are caught by the camera under the wings of Eros. Below, Princess Alexandra is seen with the national winner, 17-year-old Roy Wilkinson, of Stretford.

Within half an hour of the prize-giving the first steps were being taken to dismantle the pastel-coloured kitchens, each of them bearing an oddly Christmassy topknot; a lady in W.V.S. uniform, munching hard, was shovelling food into tin containers (it was destined for Dr. Barnado's Homes from which a brother and sister had been chosen to present a bouquet and souvenir programme to the Princess), and on one stand an engineer well known in North Staffordshire could be observed solemnly drying up.

Naturally—for this was a very glamorous final—the event achieved publicity at national level. But in our view it would be quite wrong to assess Youth in the Kitchen by this particular yardstick. The value of the competition to the gas industry lay not in the climactic frenzy of the Café Royal, but in the earlier rounds. In the rarefied atmosphere of a national final the fact that it is a *gas* show can be lost all too easily. But, let us not forget, since the competition began, 35,000 youngsters have used modern gas appliances; friends, relations and others have watched them; and educational authorities have given their blessing and encouragement. Taken by and large, there are plenty of worse ways of enlisting tomorrow's consumers.

Reorganisation and new projects in the Southern Area

The new works at Kingston, I.o.W.

ONE YEAR'S WORK

THE Southern Gas Board area covers 5,700 sq. miles, the whole or part of 13 counties and is bounded by six area boards—seven if we include Gaz de France. It embraces the Isle of Wight, but unfortunately not the Channel Islands. Some of its coastal strip is well populated, but inland there are extensive stretches of beautiful country such as the New Forest, Berkshire Downs and Salisbury Plain, without a customer in sight for miles. There are Service establishments at Aldershot, Portsmouth and Farnborough, which account for high coke sales. Its principal industries are oil refining at Fawley, shipbuilding at Southampton and Cowes, the car industry at Cowley, biscuits at Reading, and pottery at Poole.

Refinery Gas

It has a population of 2.7 mill. with a growing number of domestic consumers whose gas consumption demand still remains high at 124 therms per consumer. The maximum weekly demand is about 735 mill. cu.ft. Coke production at 753,000 tons in 1957 did not meet demands and 60,000 tons had to be purchased from other boards. The increasing use of refinery gas to take the place of coal gas is further reducing the coke production.

On vesting day the 63 separate undertakings required to be co-ordinated and, for the conditions then prevailing, the problem of organisation under a responsible board was wisely met by creating four miniature area boards or divisions which were further subdivided into groups. Due to difficulties of communication determined by geography, these divisions had, necessarily at that time, a high degree of autonomy. With varying degrees of vigour and according to opportunity they pursued their individual policies and established a cohesion which did not exist before. This was at that time an appropriate evolutionary development but it was becoming increasingly clear that the divisional boundaries were artificial and hampering area development. It was not to be expected that a particularly ambitious division would allow itself to be completely dependent for its gas supplies upon another division even when it would have been more profitable to the board to do so. When the third Chairman, Mr. C. H. Leach, took up his duties in 1956, the movements towards an area conception of organisation which had already begun were rapidly accelerated. After the appointment of the area heads of departments the changes became absolute on November 1, 1956.

There is some similarity between the new regions and the previous divisions. These were:

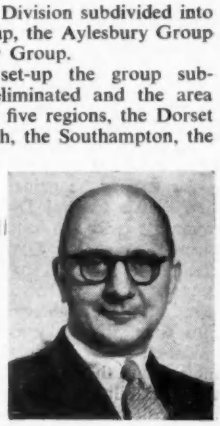
The Western Division subdivided into the Bournemouth and the Dorset Groups.

The Eastern Division subdivided into the Southampton Group, the Portsmouth Group and the Isle of Wight Group.

The Central Division subdivided into the Northern Group and the Southern Group.

The Northern Division subdivided into the Oxford Group, the Aylesbury Group and the Banbury Group.

In the new set-up the group subdivisions were eliminated and the area was divided into five regions, the Dorset and Bournemouth, the Southampton, the



DR. A. E. HAFFNER,

A.R.C.S., M.I.Chem.E., F.Inst.F., M.Inst.Gas E.,

CHIEF ENGINEER, SOUTHERN GAS BOARD.

From a paper to the Midland Junior Gas Association on March 25.

Wight and Portsmouth, the Reading, and the Oxford regions.

Southampton, instead of being a group, had become a region because of its growing importance through the intake of refinery gas, and Salisbury was transferred to the Southampton region because of the imminence of its integration with Southampton. For production purposes it was decided to combine the Reading and Oxford regions because of the declining production in Oxford and the rapid development of Reading following the decision not to build a new works at Cowley.

In each region there were appointed regional officers to control production, distribution, sales and service, accountancy (office controllers) and labour, each as distinct and separate functions and each officer separately responsible to his area departmental head.

Since the engineering department is perhaps the most interesting to this Association, its organisation will be dealt with in detail.

The Chief Engineer is supported by two specialist officers—the Production Engineer and the Distribution Engineer, both of whom have direct contact with the Chairman, particularly by serving with the Chief Engineer on the Chairman's Committee. This is the highest executive committee, supplying the board with information and implementing decisions made by the Board. The regional engineers are responsible to the Production and Distribution Engineers at Headquarters.

Following the Chairman's Committee there is a monthly Engineers' Committee, occupying a whole day. The morning is devoted to a combined meeting of regional production and distribution engineers under the chairmanship of the Chief Engineer, when topics are discussed to avoid the pitfalls of too water-tight a separation between the two aspects of engineering. In the afternoon the Production and Distribution engineers separate to deal in greater detail with their specialist problems. At these meetings there are regular attendances for part of the time by specialists to deal with coal, coke and occasionally with costs, labour and statistics.

Flexibility

So many of the schemes being developed involved an area concept and so much was to be gained by standardisation that a Central Drawing Office was organised with an establishment of 18 draughtsmen. They were derived to a great extent from previous divisional drawing offices and also by direct recruitment. The draughtsmen are subdivided into four principal groups, civil, mechanical-electrical, production processes and mains, but the greatest use is made of their flexibility to concentrate on particular projects according to the diverse demands. It so happens that compressing plant and the grid system have taken up more than half the time, but soon the emphasis will swing to other types of projects. The work of the drawing office has been facilitated by engaging the services of electrical consultants.

A Central Laboratory has been established in Poole in premises formerly occupied by Gas Council research staff, with the objects of undertaking repetitive routine testing of more transportable samples from all the works, to assist in bulk purchase of oils, paint and refractories, to establish centralised records to facilitate technical control and to acquire specialised knowledge on effluents, atmospheric pollution, instrumentation, including calorimetry, and plant trials.

Centralised routine testing is clearly applicable to those analyses which are not wanted at short notice and clearly cannot apply to *in situ* testing. The small chemical staffs on the works obviously have to deal with these, but it is believed that freed from much routine analyses and benefiting from such services as instrument calibration, making up standard solutions, etc., they can the better devote themselves to perform their chemistry on the plant rather than on the bench.

There are monthly meetings under the chairmanship of the Chief Chemist to enable the works chemists to discuss freely chemical problems and to establish uniform standards of testing. The value of this work has been clearly demonstrated.

The organisation of safety measures had been carried out in different parts of the area with differing degrees of effectiveness and the enthusiasm of the individuals concerned was not co-ordinated.

A Safety Officer was recently appointed on the Chief Engineer's staff and this made available the necessary advice and guidance right from the design stage to the grimmer aspects when safety measures have failed. Statistics on the Ro.S.P.A. basis were prepared for the first time for individual works and revealed the need for concentration on the less satisfactory works, although the average for the whole board compares favourably with other areas.

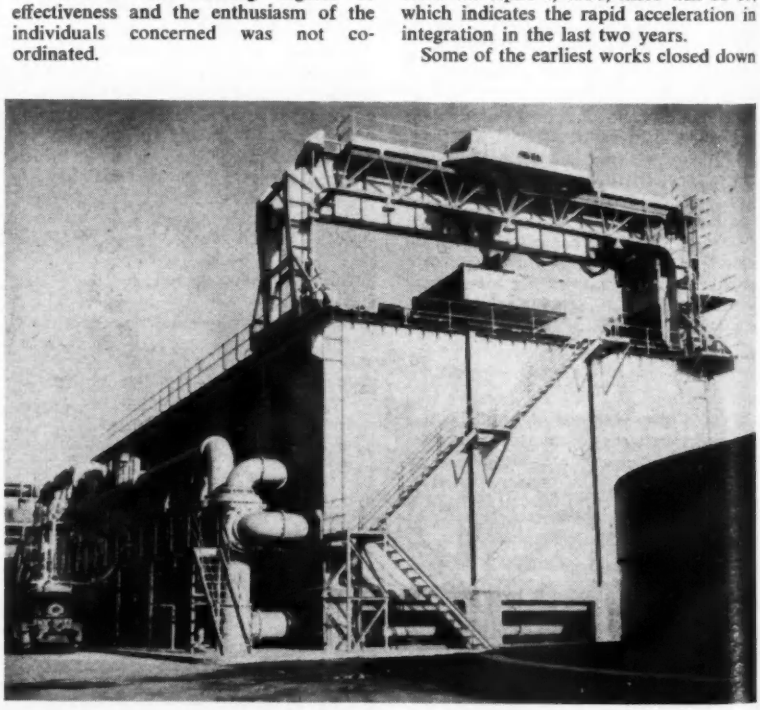
Although the safety organisation at a works is an inescapable responsibility of the works superintendent, it is now intended to nominate at each works of sufficient size an assistant engineer of suitable experience to be responsible for detailed execution of safety measures and to be ready to consult the Safety Officer at Headquarters at any time and regularly through a safety committee.

All this organisation and all this committee work is, of course, a means to an end and it is believed that the reorganisation has enabled us to approach our objectives more effectively and more rapidly.

Acceleration

Integration of the area's gas distribution system had been in progress long before nationalisation. When nationalisation destroyed the significance of previous local boundaries of supply, integration was speeded up and of the 62 works on vesting day, 39 remained on April 1, 1956. On April 1, 1958, there will be 17, which indicates the rapid acceleration in integration in the last two years.

Some of the earliest works closed down



Tray purifier installation, Southampton.

required 700 man days to make 1 mill. cu.ft. compared with our best works needing 19 man days. Works recently closed down in Dorset were producing gas into holder at a greater cost than the selling price and the margin between costs at Poole and in Dorset was amply sufficient to cover the costs of bulk transmission. Such small works, however efficiently they had been run by devoted engineers, cannot possibly compete with large works with the economies brought about by scale and through increased mechanisation, technical control and greater co-ordination of steam power.

It is therefore our declared intention to establish a comprehensive area grid system and it is at once admitted that this object is fairly obvious; indeed its achievement is likely to be well behind other area boards. Already some divisional integration has taken place, particularly in the Reading region and an account of the Aldershot integration scheme has already been published. (I.G.E. Communication No. 445.)

Regional Zones

As a first step towards a single grid system it was necessary to establish a uniform basis of calorific value. By July 1, 1956, with the change in declared calorific value at Southampton from 460, the declared calorific value for the area became uniformly 475 B.t.u. per cu.ft., with its combustion characteristics falling within the range of G.5 gases.

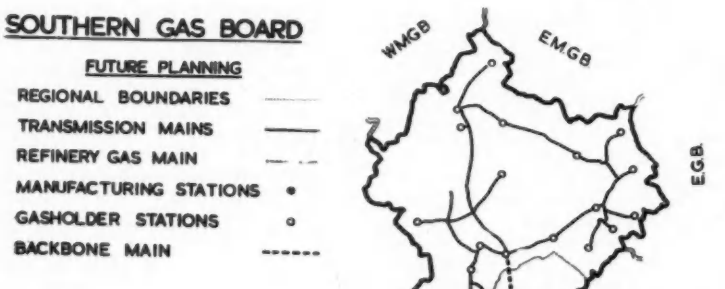
The area grid can be subdivided naturally into four regional zones involving:

1. The completion of the connection of all the Dorset works to Poole.
2. The completion of the connection of all the remaining works—Salisbury, Winchester, Whitchurch and Andover in the Southampton region to Southampton.
3. The completion of the connection of the remaining works Selsey and Bognor with the Hilsea, Flathouse, Gosport Group.
4. The Reading region was already well advanced in integration but Newbury is still isolated.
5. The completion of the connection of the remaining works in the Oxford region—Banbury and Bletchley, etc., to Oxford.

Connections

The connection of two works—a large works and a smaller, does not necessarily imply that it is intended to close down the smaller, which may be operated as a base load station and be held in production until new processes of gas making have been installed at the larger works. These separate schemes were proceeding simultaneously but as such they would only have established five individual local grids and to obtain the advantages of a comprehensive grid system it was necessary to establish connections between them: (*a*) By joining the Southampton and Portsmouth regions and (*b*) by the 'backbone main,' connecting Poole, Southampton, Reading and Oxford, picking up Whitchurch, Andover and Newbury on the way. The planning of the area gas grid has been carried out in stages chosen to bring about earliest closing of the least efficient works and to spread out the programme region by region so that no region had too great a bulge in its work.

The programme for building the new Kingston works was so advanced that it was too late to give renewed consideration to the linkage of the Isle of Wight to the mainland grid by a submarine



main. Nevertheless, the Isle of Wight has now been integrated within itself and the new Kingston works has taken over the production from five smaller works. The formation of the Island grid did involve an interesting submarine crossing of the estuary of the Medina with two gas mains and two water mains.

The backbone steel mains have been supplied internally painted with red lead, externally protected by a wrapping of bitumen into which woven glass is drawn while hot, and have been welded by the stovepipe technique under gamma ray control. The joints have been further protected by priming and wrapping with hot bitumen into which fibreglass scrim is drawn and the joints are 'holiday' tested before snaking the main into the trench. Soil surveys have been carried out and cathodic protection applied where necessary.

Thrust Boring

Wherever applicable thrust boring has been used in crossing under railway embankments and in a special case by thrust boring under the River Test, operating from pits sunk on either side of the river. This was specially done in deference to the needs of the salmon fishermen and demands of the owners of the fishing rights.

Purging of mains, steel and cast iron has been carried out safely and cheaply by the nitrogen plug method,

The cast iron mains of the system are planned to operate at 10 lb. per sq. in. gauge and the steel mains initially at 30 lb. per sq. in gauge, although the steel mains themselves will be capable of operating at 150 lb. per sq. in gauge.

The route of the backbone main is not inconsistent with thoughts being expressed about the national grid and if the Southern Gas Board were called upon to supply gas into a future national grid from gas derived from products of oil refineries on Southampton Water, the backbone main would be able to transmit 50 mill. cu.ft. a day at the maximum allowable pressure of 150 lb. per sq. in. gauge with intermediate compression.

The closing down of small works and their conversion to holder stations has led to a standard design of booster and governor control gear in standard buildings designed to combine effectiveness with low maintenance and acceptable appearance. The control gear is fully automatic, clock controlled and provision has been made for later introduction of remote control when a central control room becomes justified. These holder stations are often distant from available labour and extending use is made of electric anti-freezing. Since the gas reaching remote holder stations has been derived from compressed gas efficiently after-cooled, or boosted gas which has been dried by calcium chloride, the district holders are oil filmed.

At November, 1956, there were 188 holders of 77 mill. cu.ft. capacity, but 35 of these, which were in poor condition, have been demolished, thereby simplifying maintenance. In spite of this, new holders have been necessary and have, or are now being, built to the extent of about 14 mill. cu.ft. capacity.

The integration schemes outlined above have, by closing down smaller works, transferred responsibility for gas production to the larger works. The total plant capacity needed after integration is not as great as the total plant capacity of all the previous works, as the spare plant for breakdowns which each unit had to install, is not necessarily needed because of the diversity effect of the integrated works and the unlikelihood of all works being simultaneously in trouble through breakdowns.

Thus, at Poole, the additional output necessary to cover the needs of integrated Dorset works could be met by making use of spare mechanical producer plant at Poole. This producer plant was installed for heating continuous vertical retorts and one producer was held in reserve for breakdown. If, however, such a breakdown occurred sufficient output could be obtained by making use of the best possible coke during such an emergency and the spare producer was therefore earmarked for increasing the gas output to cover the Dorset needs, the necessary enrichment being derived from an increase in the calorific value of carburetted water gas. In addition, virgin naphtha will be used for fuel bed reforming in carburetted water gas plants.

Enriched

At Southampton the additional needs have been met by the intake of Fawley refinery gas which began in July, 1957, immediately after completion of the 15-mile main. Until two 8 mill. cu.ft. per day Onia-Gegi self-steaming gasification units are put to work in October, 1958, the refinery gas is being reformed in the fuel beds of three 2.5 mill. cu.ft. per day c.w.g. sets, but their combined output is 12 mill. cu.ft. per day with an efficiency of 85%. Refinery gas is admitted with steam during most of the back run and most of the up run and a gas is produced with a calorific value of 340 B.t.u. per cu.ft. and this is enriched automatically with unreformed refinery gas to the declared calorific value. The organic sulphur content of the gas is below 10 grains per 100 cu.ft. and, mixed with 20% coal gas, it is now being supplied to Southampton, Winchester, Salisbury, and sometimes to Fareham and Gosport. This supply of gas has directly or indirectly enabled horizontal retort installations, or the whole works, to shut down at eight works, with corresponding relief in the difficulties of implementation of the Clean Air Act.

The refinery gas is subject to being reduced to lower prescribed levels when the catcracker is annually overhauled and under these conditions and for emergencies the reforming plants can be quickly changed over to other feedstocks such as oil or virgin naphtha. In practice the prescribed lower level has been greatly exceeded.

A purification plant has been installed consisting of tray purifiers with a capacity of 8 mill. cu.ft. per day.

At Hilsea a 2 mill. cu.ft. per day self-steaming Onia Gegi plant went to work in December, 1956, and was for a brief space the largest of the type in the country. Scaling up from earlier versions carried with it a few unknown problems. Because of the unidirectional flow of the

gas, its temperature leaving the self-steaming plant is higher and more carbon appears in the tar; experience had to be gained in handling it. Curiously enough, the addition of naphthalene from the direct cooler greatly reduced the viscosity of the tar. Self-steaming sets are also provided with hot detarrers at the immediate outlet of the washbox and the combination of high tar content and high temperature was often beyond the capacity of the detarrer. Gradually these difficulties are being resolved, the guarantee figures have been attained and a higher standard of availability has been established. Here again the c.w.g. plants and catalytic plant at Hilsea are being equipped to be able to use virgin naphtha as a feedstock.

Reduced Expenditure

The Reading and Oxford regions are already considered together from the production point of view because the needs of Oxford are already being supplemented by the supply of 5 mill. cu.ft. a day from Reading, and this is to be increased to a higher level as soon as the two 3.75 mill. cu.ft. per day Segas plants and the backbone main from Reading to Oxford have been completed. The future of the Oxford region was once thought to be bound up with the building of a much publicised works at Cowley to be based on conventional carbonising plant and c.w.g. sets. At the last moment all this was cancelled in the belief that a new works of only 10 mill. cu.ft. per day capacity of traditional design could no longer be justified and in effect the expansion of Reading by oil gasification (and possibly augmented by Southampton gas based on refinery gas) has taken the place of the Cowley works, at greatly reduced capital expenditure.

All these schemes aim at reducing costs of manufacture by eliminating small works with high labour requirements and by shutting down uneconomic plants on the large works and replacing them with larger plants with lower labour requirements. Thus the two 8 mill. cu.ft. per day catalytic reforming plant at Southampton requiring seven men per day can be regarded as replacing several horizontal retort houses of the same total capacity but requiring about 200 men.

Half-way

The work which has been completed in the first year of reorganisation naturally deals with the completion of earlier schemes besides the starting up and completion of new ones.

Even so, we are now about half-way toward the declared objectives, but the final target cannot be rigidly defined and it is constantly necessary to be in readiness to turn to new processes and new raw materials. The proximity of a large refinery has influenced our plans, but it is unwise to adopt any process, be it based on coal or petroleum, if it is inflexible in its range of raw material or depends on the stable prices of its by-products. It is wise that each board according to its circumstances should gain its own experience of new processes without duplication of the pilot plant stage in more than one board. There is every need, therefore, for the engineers of all boards to exchange experiences more freely than ever before.

DISCUSSION

Mr. D. J. O. Bath, President of the Association, thanking Dr. Haffner for his address, said that the Association had been given a very comprehensive account of the reorganisation which had taken place in the Southern Gas Board during 1957, and the many difficulties encountered. He would, however, like to hear from members of any difficulties they themselves had experienced.

Mr. S. Brockbank, Newcastle-under-Lyme, referring to the 'nitrogen plug' used for purging the main linking up the oil refinery at Fawley with Southampton asked if the rate of flow of the purge gas, given by Dr. Haffner as 7 m.p.h., was the limiting speed at which nitrogen could be used for this purpose and had any experiments been done to prove that this speed did indeed represent the limit. He agreed with Dr. Haffner that the degree of intermixing at each end of the nitrogen plug would be very small.

He was glad to hear that Dr. Haffner believed in a flexible outlook in the matter of the choice of raw material for the production of gas and felt that all gas boards should explore every possibility before being content to make gas from the cheapest source.

Dr. Haffner, replying to Mr. Brockbank, said that 7 to 10 m.p.h. was the appropriate rate of flow of the purge gas, but the important point to bear in mind was that it was necessary to maintain an uninterrupted rate of flow in order to prevent diffusion, since to increase or decrease the rate of flow could possibly increase the degree of diffusion.

In the matter of flexibility in the choice of raw material for gas production, he fully realised that the possibilities open to his own board differed greatly from those open to other boards operating in areas with large supplies of coal or with coke ovens. Although the Southern Gas Board could use the refinery gas from Fawley he appreciated that the gas industry as a whole was still primarily dependent upon coal and he was by no means completely 'wedded to oil.'

Mr. J. Foxton, Cheltenham, asked whether it would not be wise for the gas industry as a whole to raise its standard c.v. He realised that a mixture of gases could give rise to troubles on the district and asked if Dr. Haffner agreed that by reducing the c.v. of refinery gas its value was also reduced.

Dr. Haffner replied that each board should decide its own c.v., which should be uniform within its own area. He then enumerated the advantages of a higher c.v. but pointed out that although it did seem a pity to reduce the c.v. of refinery gas, it should be realised that this gas represented only about 15% of the output of the Southern Gas Board and that the c.v. of the refinery gas varied greatly. A c.v. could not therefore be selected on the basis of the c.v. of refinery gas.

Mr. B. G. H. J. Hawkings, Coventry, asked why the water mains crossing the River Medina were flanged while the gas mains were welded. As to the welding of gas mains, what were Dr. Haffner's views on the subject of ultrasonic testing of welds and, in the laying of mains across the Medina, had there been any bacterial attack? He also asked how the bitumen and fibreglass scrim was applied in the protection of the joints of the backbone main.

Dr. Haffner said that the gas mains crossing the Medina were welded to ensure gas tightness, while the water mains, which were the responsibility of the Water Authority, were bitumen lined and therefore not welded but flanged. As to the use of the ultrasonic method of testing welds, this method, although it was rapid, gave no permanent recorded evidence of such testing and it was also necessary to employ trained observers but those available were few in number. He then invited Mr. Bentley to reply to the remaining points that had been raised.

Mr. S. C. Bentley, Southern Gas Board, Oxford, agreed with Dr. Haffner's views on ultrasonic testing of welds and added that by this method it was possible only to detect a fault, but its extent could not be determined. Nevertheless, both ultrasonic and gamma-ray testing were used in the Southern Gas Board. He went on to say that the reorganisation in the Board's area had been a great source of satisfaction and the work was being tackled with a great deal of enthusiasm. Its tempo had increased mainly because it had become possible for men to concentrate all their efforts and energies on one particular job at a time. Referring to Mr. Hawkings' query regarding the use of bitumen and fibreglass scrim for protecting the joints of mains, he said that in the U.S.A. coal tar was used but the practice in Britain was to use bitumen. The first application of fibreglass scrim and hot bitumen after a primer produced a hard coating. The second wrapping of fibreglass scrim was applied by holding it in position round the main and pouring on the bitumen. A final enamel coat was then applied.

Mr. L. H. Hardy, Birmingham, referred to the mains crossing the River Medina and asked how the dipping was done and the condensate removed from the main.

Dr. Haffner said that a hydraulic-type tube, coated with red lead, ran inside the main from the lowest point to an outlet connection on the river bank. The gas pressure was sufficient to raise the condensate through it for removal by an ordinary suction unit.

There was also an $\frac{1}{4}$ in. stainless steel nylon-coated wire laid through the main under the river to facilitate removal and replacement of the syphon service if required.

Mr. S. C. Porter, Junior Vice-President, Birmingham, asked about the characteristics of the refinery gas. What was its H_2S content and how was the gas metered?

Dr. Haffner, replying, said that the main

characteristics of temperature, pressure, c.v. and H_2S content would be recorded and telemetered continuously, but work in this connection was still to be done. The H_2S recording depended on dilution of the refinery gas to bring its content of 1% to 2% H_2S within the scope of the instrument.

Mr. C. P. Astbury, Birmingham, said that in the construction of the backbone main he felt that it would be difficult to co-ordinate the production of the various works for day-to-day requirements of gas and asked what stocks were held.

Dr. Haffner replied that the complete co-ordination of the works to meet day-to-day requirements of gas had not yet been attempted and proceeded to explain that surplus gas at Southampton was already being sent to Portsmouth, and Reading gas was being delivered to Oxford. As the gas grid was completely established, the need to co-ordinate the works would become greater and a control centre would then have to be established. The total gasholder capacity in the board's area was 77 mill. cu.ft. with a maximum day's output of 120 mill. cu.ft. Many holders had already been demolished because of their small size, condition or inappropriate locality due to reorganisation.

Mr. W. Jones, Stoke-on-Trent, said that his experience of the use of bitumen and fibreglass scrim for protecting joints in mains was that this could be done better by using moulds.

Mr. S. C. Bentley agreed that there was some waste of bitumen in wrapping the joints by the method to which he and Dr. Haffner had already referred, but it had the advantage of being quicker and, he considered, cheaper in the long run.

Mr. F. Lake, Radiation Ltd., referred to the reasons given by Dr. Haffner for breaking down the high c.v. of refinery gas and expressed the view that this gas would not burn satisfactorily in gas appliances designed for town gas. In the U.S.A. appliances had to be modified to burn natural gas produced there. If, therefore, natural gas or refinery gas was to be used he felt that it should be mixed with town gas. He said that he felt that gas engineers tended to produce gas without giving sufficient consideration to what its constituent gases were. He therefore asked Dr. Haffner if he would give particulars of a typical mixture of the gas he sent out.

Dr. Haffner, replying, said that his board's aim was to make gas with combustion characteristics which fell within the range of G.5 gases. A typical analysis of Southampton's town gas was as follows (expressed as percentages):—

CO_2	O_2	CnHm	H_2	CO	C_2H_4	CH_4	N_2
3.1	1.4	2.7	44.8	16.8	5.7	10.5	15.0

Refinery gas, he said, varied in c.v. from 800 to 1,600 B.t.u. per cu.ft., due to the varying sources from which it came. It was easier to reform the gas as low as possible and then 'top up' with neat gas rather than to reform it to 475 B.t.u. per cu.ft.

Mr. D. Dawson, Smethwick, referred to the 'nitrogen plug' method of purging mains mentioned by Dr. Haffner and asked how much nitrogen the distributing engineer would need to put into the main and enquired what were the transmission costs in the backbone main.

Dr. Haffner, in reply, said that the amount of nitrogen to be put into the main was 600 to 800 yards length of the main. It was the intention of the Southern Gas Board to transmit gas at 30 lb. per sq. in. pressure and not at 150 lb. per sq. in., although the steel mains would be capable of operating at this pressure. There would, therefore, be no significant difference in the costs of transmission in his board as compared with those of other boards.

Mr. H. G. Abraham, Alexander Comley Ltd., asked why the c.w.g. plant at Southampton was being replaced by an Onia-Gegi plant.

Dr. Haffner replied that the quantities of refinery gas were limited. The agreement to take refinery gas from Fawley was signed in July, 1956, and the necessary main laid within 12 months. It was considered that the easiest way to use this gas was to put it through the c.w.g. plant until the Onia-Gegi plant was ready to be put into operation in October, 1958. The c.w.g. plants would then be operated on virgin naphtha.

Natural Gas is Raw Material and Fuel in Synthetic Rubber Plant

£48 MILL. PROJECT OPENS IN ITALY

NATURAL gas is both the raw material and the fuel in Europe's largest synthetic rubber and fertiliser plant which has just been opened in Italy at Ravenna, by the State-owned Company, Anic, which is affiliated to the National Hydrocarbon Organisation.

The methane is broken down to produce acetylene in the biggest acetylene-generating plant in the world, and the hydrogen released is converted into ammonia. When production is in full swing in a year's time, Ravenna will be producing 60,000 tons of rubber and 760,000 tons of fertiliser (ammonium sulphate and ammonium nitrate) a year.

The plant covers 500 acres, and 300 more have been acquired for future expansion; 60,000 tons of steel and cement were used in the construction of this £48 mill. project.

Control Switched

ADMINISTRATIVE control of customer service in the Liss and Midhurst districts of the Southern Gas Board has been transferred to their Portsmouth regional office.

COMPANY SECURES £3.75 MILL. COKE OVEN CONTRACT

A CONTRACT worth more than £3.75 mill. has been placed with Gibbons, Brothers, Ltd., a subsidiary of Gibbons (Dudley), Ltd., for the construction of coke ovens at a new steel-making plant for the South Durham Steel and Iron Company, Ltd., West Hartlepool. Besides the coke ovens, Gibbons Brothers, Ltd., have already received orders for four large reheating furnaces for the same works.

Completion of the first stage of construction is expected early in 1960 and the whole contract is due to be finished in 1961.

Commenting on the contract on Wednesday, May 14, Colonel W. E. Gibbons, the Company Chairman, said: 'This, in addition to other orders we have in hand or expect, will keep most divisions of our Company busy for the next two or three years, which is very encouraging during present rather difficult trading conditions.'

GAS APPLIANCE SALES RISE IN N.W.G.B. AREA

GAS appliances sold by the North Western Gas Board during the financial year ended March 31, 1958, worth £3.4 mill., represented an increase of 13.6% over the previous year's sales. Sales by hire-purchase accounted for £2.3 mill., an increase of 20.8%; and cash sales at £1 mill., an increase of 5%.

Sales of gas cookers, the biggest single item, were 19.9% up, and more gas space-heaters and refrigerators were also sold.

The value of appliances sold during the five-week period ended March 31, 1958, was £372,942, an increase of 18.8% on the sales for the same period last year. Sales by hire-purchase amounted to £258,823, an increase of 22.2%, and cash sales to £114,119, an increase of 11.8%.

New Transistor Firm Formed

A NEW Company has been formed by the Automatic Telephone & Electric Co. Ltd., the English Electric Co. Ltd., and Ericsson Telephones Ltd., for the development and manufacture of transistors and other semi-conductor devices.

The new jointly owned Company is to be known as Associated Transistors Ltd.

From a paper to the Eastern Junior Gas Association, April 17.

Towards Preventive Maintenance

By W. M. JOHNSTON, M.Inst.Gas E., A.M.Inst.F.,
ASSISTANT WORKS ENGINEER, LUTON WORKS, WATFORD DIVISION, EASTERN GAS BOARD.

A FUNDAMENTAL characteristic of the process of gas manufacture is that it is continuous. This feature carries with it the advantage of high load factor for the working of the plant. This is an important advantage in view of the high capital cost of gasworks plant but an advantage which can be obtained only by constant vigilance in maintaining the plant in efficient working order. Further stress is laid on maintenance by the trend towards increased mechanisation in gasworks processes with its concomitant need for a high standard of electrical and mechanical services; furthermore the high cost of all plant makes the provision of standby plant subject to stringent review. The tendency is to cover the minimum safety requirements and to lay on the maintenance department the onus of avoidance of breakdown. But the problem of the avoidance of breakdown is even more acute in those less fortunate works which, stricken by the blight of the credit squeeze, are condemned to face the rigours of continuous production with plant which has long exceeded its normal span of life. Breakdown is an expensive indulgence which may bring in its train loss of production, replacement costs, high labour costs, perhaps for work at night or at week-ends, and a disruption of normal routine. It can be avoided only by regular and systematic attention to the plant and it is incumbent on those responsible for the continuous and efficient operation of plant to form a policy for maintenance which will achieve those ends by making use of all available techniques, administrative or technical.

Ultimate Goal

The Productivity Report on Plant maintenance[1] found it useful to define the main types of maintenance policy and arrived at five classifications, each stage being an advance on its predecessor until the fifth stage represents the ultimate goal of preventive maintenance. The following is, in outline, descriptive of the five stages:

(i) Controlled by production supervision. The satisfactory use of this method is confined to the engineering industry, where supervisors and employees have the qualifications necessary to control and perform maintenance work. Even in these circumstances the lack of separate control of maintenance records and costs may disguise the real size of the maintenance problem.

(ii) Breakdown. In this system an independently organised maintenance section acts as an emergency repair service, summoned by the production staff when interruption to or restriction of production has actually occurred. This method reduces the availability of plant and gives a lower overall plant efficiency than could be obtained by other methods.

(iii) Scheduled. The fundamentals of this stage (an essential one in the approach to preventive maintenance) are the provision of an inventory of major items of plant and an annual production and maintenance programme so that the periods of availability of the various items of plant can be determined and put to use for maintenance purposes.

In this way the 'where' and 'when' of the maintenance programme can be approximately fixed and the most efficient use made of idle time.

(iv) Planned. This development of scheduled maintenance endeavours to answer the questions 'What?' and 'by whom?' Experience of scheduling is used to make more detailed analysis of programmed work, so that more precise planning of work and allocation of labour to it become possible. At this stage the use of work study for estimating the work content of the jobs becomes desirable.

(v) Preventive. For a system to justify this title it must get to the basic 'why?' of maintenance work and relate performance to some more absolute standard than that of previous experience. The policy must be upkeep, replacement and modification rather than repair, and familiarity with an established system of planned maintenance will simplify the approach. Work of an inspection, maintenance, replacement or modification nature is assessed for the lifetime of each item of production or service equipment and is broken down into elements which are analysed to improve methods and determine standard work contents. At this stage the techniques of work study become indispensable.

Quite obviously no systematic maintenance would be possible without an adequate file of records and it could only be with the assistance of such a body of recorded history that progress to preventive maintenance would be conceivable. At the same time, complexity must be avoided and the aim should be to provide the maximum of information and control with the minimum volume of paper. As indicated above, the first essential is an inventory of plant in which each item of plant is listed, together with such details as the maker's name, the maker's reference number, location, the date supplied, the original cost, as well as the reference drawing numbers, essential spare parts, technical details such as H.P. voltage, phase, speed, etc., and the works reference number. The last-named item is important for, once established, a suitable numbering system can greatly facilitate the whole process of reference and costing. It is suggested that the best method is to number each item in accordance with the cost code to which it belongs; for example, if the code for exhausters were W640 the exhausters and their ancillaries would be numbered respectively, W640.01, W640.02, and so on. This makes use of the decimal coding system in which each digit of the reference number is significant and indicates a separate classification of the section to which the code heading applies. Such numbering could be used for drawings or for any other purpose that may present itself and would offer a unified structure of reference throughout the works or, for that matter, division, since the relevant cost code is standard. Furthermore, such a method would lend itself to the application of mechanical aids in the form of punched card sorting machines.

Useful Step Forward

From this inventory some idea of the magnitude of the maintenance problem will be obtained and it is a simple but useful step forward to combine in the inventory a maintenance inspection and overhaul record by providing space for such information as the period of inspection, the period of overhaul, the dates of inspection, the dates of overhaul, and notes on work done and replacements made. A standard loose-leaf sheet arranged to provide this information with the inventory facts on one side and the maintenance record on the other is supplied in a patented form by at least one supplier of office systems. The edge of this sheet is marked off in date order and a marker which is made to slide along this edge shows the date when the next inspection or overhaul is due. The sheets are contained in appropriate order in a binder so that all the markers are visible; by constant reference to this file it is simple to plan in advance the inspection and, to some extent, the overhaul of plant. The frequency of inspection and overhaul of equipment

can be determined only by experience but a useful guide for many items of gasworks plant has been provided by W. Morland Fox[2]. Having completed the inspection or overhaul any significant points which arise can be noted for future reference. In this way the burden of memory can be removed from the fitters and foreman and relevant facts become easily available on which future decisions can be made with reasonable certainty. At this stage it may be found that further knowledge is required to control the scheduling of major overhaul and it becomes necessary to examine the production programme in detail in order to plan the efficient disposition of the maintenance squad to give proper attention to plant throughout the year. For this the simplest instrument is the master chart, on which the various items of plant are listed in vertical column against a horizontal time scale and appropriate periods are set out for the various projected overhauls at times when it is known that the plant will be available. It is easy to add details to the chart as necessary; for example, the individual tradesmen can be allocated in advance to their respective jobs and identified on the chart by a simple device or, again, plant may be sub-divided and the sub-division, perhaps requiring attention at different times, indicated on the chart by numbers. It is particularly helpful to dispose the tradesman in advance on the basis of the prepared holiday list in view of the dislocation that can occur when the procession of holidays takes place from May to September, the peak period for gasworks maintenance. At this stage of development a system might be said to approximate to the definition of 'Scheduled Maintenance' in which, perhaps, the germ of 'Planned Maintenance' is taking root.

Full Specification

It cannot be said that a job has been planned unless full details are known in advance of the work to be done, the material required and the time to be taken. A full specification is required and this specification should be made available to the man who is to do the job. In planned maintenance organisations this is done by means of job cards on which the work to be done and the material required is shown and also the time allowed for the job if work study is sufficiently far advanced to permit of this. In this way a tradesman learns of what he has to do without himself going to inspect the job, knows what material to use without himself having to measure and estimate, and in consequence much loss of valuable time is prevented. This argues a degree of organisation which is dealt with later. The use of job cards is not common in gasworks although they are essential on the district. The need on the district is apparent since the field is scattered and much of the work is chargeable to the consumer; but the cost of the works maintenance department is no less chargeable to the consumer, it is numerically not much smaller and handles in a year not much less in value of material than the district fitting staff, while the ratio of capital value of plant maintained to the cost of maintenance is incomparably greater in the case of the works department. There seems no doubt that job cards offer a degree of control that should give them their place in the works maintenance organisation, given a satisfactory state of scheduling or planning.

Incidence of Breakdown

A refinement that some firms introduce at this point, is a method to distinguish between scheduled work and breakdown. Special job cards are issued for breakdown jobs so that a check can be kept on the frequency of these as a measure of the effectiveness of the maintenance system. In addition a special cost coding may be issued for breakdown work to enable the cost of this to be readily ascertained. The incidence of breakdown is a vital factor in the maintenance organisation and it is of interest to assess it. Scheduled work is classified as that which has been prepared in advance. Unscheduled work is that which appears from day to day to be necessary as a result of report by production staff or observation by the maintenance staff. Breakdown is not necessarily emergency breakdown but is taken to mean that immediate and urgent attention is required as a machine has had to be stopped or a standby put into operation. The organisation for dealing with maintenance in the Billingham division of Imperial Chemical Industries, Ltd., indicates the proportions of scheduled, unscheduled and breakdown work which are acceptable in that organisation. It is claimed[3] that experience has proved it possible to reduce the incidence of unscheduled, unplanned work to 1% or less by full use of preventive maintenance methods.

Several references have been made to the requisition of materials from the stores and it is apparent that no satisfactory maintenance organisation can be sustained unless it is backed by an efficient stores system. It is essential that vital spare parts are kept in stock and re-ordered as required, and the only effective way to ensure this is to specify on stock ledger cards minimum stock levels at which re-ordering is required. In the course of time suitable stock levels for spare parts will be determined from the maintenance record. This method also operates to establish maximum stock levels so that no surplus stock need be carried. A suitable figure for the value of spare parts carried for mechanical plant has been given[2] as 5% of its capital cost. One important function that an effective maintenance record and stores system performs is to bring to light the multitude of spares that must be carried when the parent plant is variegated. The virtues of standardisation become very clear when spares have to be provided for a variety of units such as is to be found in many of the older works. It is not difficult to find examples to show the benefits of standardisation. If three similar units are required, but different types are obtained each costing, say, £1,000, then spares are needed for each. At 5% the cost of spares would be £150. But if three identical units are purchased, the cost of spares need only be £50 and the £100 thus saved can be put to use elsewhere instead of languishing in store where it may incur interest charges.

Many types of record can be of use for specific purposes. Apart from statutory records for chains, gasholders, etc., others can record lubrication[1], running time of machines or ton-miles of conveyors[1], electrical insulation tests[2], and other information that is wanted continuously or for a limited period, according to local requirements.

Decimal System—the Link

The purpose of any organisation is to fulfil its function at the optimum efficiency consistent with reasonable cost, hence the need for an adequate measure of both efficiency and cost. The systematic approach so far described should ensure scheduled maintenance the efficiency of which can be measured in terms of production levels, absence of breakdown and reduction of spares stock. Provision must be made to measure the cost of this service to ensure that it does not grow out of proportion to the task it has to perform. Although costing is being considered at this stage it is evident that in practice it would be the primary factor in the design of any maintenance organisation for, as has already been pointed out, considerable simplification is possible by tying the job and records system to the cost control. The decimal system of coding is the link in the chain of control; it permits infinite detail to be examined, if required, and supplies a standard method of reference that can be applied to everything covered by the cost code. By applying this system to all units on the maintenance record it would be possible to single out any item for cost analysis. If it were necessary, for example, to compare running cost with replacement cost for a specific item, the cost of all work and material expended in the given period against the relevant reference number could be abstracted and examined. There is a limit to this application since too much examination of detail beyond the usual code headings would become prohibitive but spot tests of this nature carried out at intervals may help to dispel illusions as to the reliability and cheapness of some long-lived and revered plant. To enable full use to be made of such a costing system, mechanical sorting would be essential and it is of interest to note that an American firm found it advantageous to use mechanical sorting equipment for its maintenance department alone when the numbers of that department exceeded fifty[1].

There is no absolute criterion against which to set the cost of maintenance. The cost of maintenance per therm of gas made takes no account of the type and condition of plant being maintained and is bound to vary seasonally. Similarly, any comparison of maintenance labour cost as against that of total labour cost is dealing with disparate factors, although such an index may, over a period, be of service. C. A. Wood[5]

has quoted a figure of 20-22½% for this ratio for Edinburgh works, a result similar to that obtained at Luton. Another index that has been suggested[1] is the ratio of maintenance cost to the capital value of the plant maintained, allowing for depreciation. But the total capital cost is difficult to determine at any given time and, as capital plant depreciates in value its maintenance cost is likely to increase, thus making nonsense of the ratio. Perhaps the best index of cost is the ratio of labour cost to materials cost, since an indication is then given of the value of material handled per man. As the cost of replacements, for a given works, is likely to be fairly constant year by year this gives a useful guide to the efficient use of labour. The ratio of maintenance labour:materials for Luton works has averaged 55:45 which compares with published figures for a British factory of 40:60, the latter figure being established after the installation of a bonus incentive scheme, previous to which the ratio was 60:40[1].

Increased Overheads

As soon as the subject of costing is broached, particularly when a new system is being considered, the question of overheads is invoked. But the term overheads is purely relative and cannot be considered in vacuo. An increase in overheads is not inherently evil; it may be accompanied by a reduction in prime costs. Some relevant and interesting examples can be quoted. In the first, an American firm of consultants engaged in the application of work measurement to maintenance organisation found that the cost of staff required in each factory for estimation and job specification amounted to 4-8% of the maintenance department payroll, while the increase in work done by the same labour force as a result of the introduction of the new systems varied from 30% to 300%[1]. Secondly, it was found by I.C.I. that the installation and operation of work measurement and bonus incentive schemes for maintenance personnel increased overheads by 5-7% while labour requirements dropped by 30% or more[3]. To come nearer home, it may be profitable to examine the familiar task of filling in details of work on time-sheets as done by the tradesmen themselves. If there are 24 tradesmen and each takes 5 minutes each morning (and it can take longer) to complete his time-sheet for the day before—if, furthermore, their 24 mates are standing by—the total time taken for the composite task is four man-hours. In four hours a reasonably competent clerk could prepare job cards for a week ahead for the entire squad. Again, it is found at Luton that between 12 and 24 calls per day are made to the stores by maintenance personnel, mainly by the fitters themselves. Assuming that the return journey from job to stores and back takes 10 minutes (a conservative estimate) and that the fitters' mates are fully occupied during this period (a generous thought), then the time taken up in this peripatetic occupation is between two and four man-hours per day. Obviously if the mates were less gainfully occupied the loss of time might reach as high as eight man-hours per day or more. Such a situation seems to offer scope for improvement and points to the desirability of a system that would enable materials requirements to be determined in advance and requisitioned in bulk. In this way most of the materials required each day could be delivered by by one stores assistant to the workshop or perhaps even to the sites of the individual jobs, common practice in the bigger factories where trucks deliver from stores to job sites. These points can be reproduced in many forms in a maintenance organisation and raise the interesting and provocative question of functionalism, which merits closer investigation.

'Divisions of Labour'

Functionalism is a rather forbidding term, the meaning of which is better expressed by economists in the phrase 'division of labour,' a concept first introduced by Adam Smith some 200 years ago.[4] As the term implies, the efficient execution of any task is achieved by breaking it up into suitable divisions of labour, each of which is attended to by a specialist. Such divisions can be pursued in more detail and an examination of the divisions of labour or functions performed in a maintenance department which does not enjoy the status of 'planned' may yield results like those outlined in Table 1.

TABLE 1.

Procedure in an unplanned maintenance organisation.

Function	Performed by
1. Job assessment and determination of method ...	Foremen and tradesmen
2. Estimating of materials ...	Foremen or tradesmen
3. Requisition of materials ...	Foreman
4. Fetching of materials ...	Tradesmen or mates
5. Doing the job	Tradesmen
6. Keeping records (if any) ...	Foremen
7. Ordering of materials ...	Foremen and storeman
8. Cost coding of job ...	Foremen or clerk
9. Responsibility for spares ... stock levels	Foremen and storeman
10. Drawings	Foremen and/or draughtsmen
11. Supervision	Foremen

It is difficult to see how a foreman can combine such multifarious duties, but by grouping these jumbled divisions according to function five distinct groups can be seen: (1) Methods and estimates, (2) clerical work, (3) stores, (4) doing the job, and (5) supervision. A new table can now be drawn up under these headings.

TABLE 2.

Functional divisions of maintenance organisation.

Function	Performed by
1. Methods and Estimates ... ... Job assessment and determination of method; estimating of materials; drawings.	Foremen and draughtsmen
2. Clerical ... ... Preparation of job cards; requisition of materials; keeping records; ordering materials; cost coding; responsibility for stock levels.	Clerk
3. Stores ... ... Delivery of material to workshop or jobs.	Stores assistant
4. Doing the job	Tradesmen
5. Supervision	Foremen

This grouping recognises the fact that foremen are the best tradesmen and therefore should have sufficient time to be able to survey all work and establish a code of practice or standard of performance for all maintenance; that clerks are better (and cheaper) for clerical work than either foremen or tradesmen; that a fitter's job is to fit; that, above all, a foreman's main function is to supervise. An organisation of this sort does not come into being overnight, it must develop gradually along the lines indicated in previous sections and it is apparent that, as the system grows, as clerical and stores control become routine, the most important place will be taken by the first group, Methods and Estimates. In attempting to make a rational approach to this matter of method it would seem that work study offers an invaluable instrument.

Work study has been described as essentially a state of mind, a mental approach to the problem of applying effort efficiently, but it has built up a comprehensive body of technique and vocabulary which is of great use in clarifying that approach. It has been applied in the gas industry originally, so far as can be ascertained, on the district[7], but more recently the works in some areas have shared its benefits.[8] Work study has two parts: (*a*) Method study, the purpose of which is to improve ways of doing work, and (*b*) work measurement, the purpose of which is to establish the work content of a task and hence to arrive at the time allowed for it. There is vast scope for method study in a gasworks, particularly in the maintenance department. This may be dismissed as paradoxical as it is generally considered that work study applies only to production, especially mass production. That is not the case; work study can be applied with profit to one man. In a gasworks the production personnel have specific duties and cannot by their own efforts measurably increase production, which is governed by extraneous factors. The maintenance personnel, on the other hand, who comprise a considerable proportion of the whole, have variable duties which they can carry out with greater or less efficiency according to their approach to their work. It is this approach, and that of their supervisors, which offers scope for method study. By comparing the frequency distribution of maintenance jobs in terms of the length of time taken to do them, as determined from

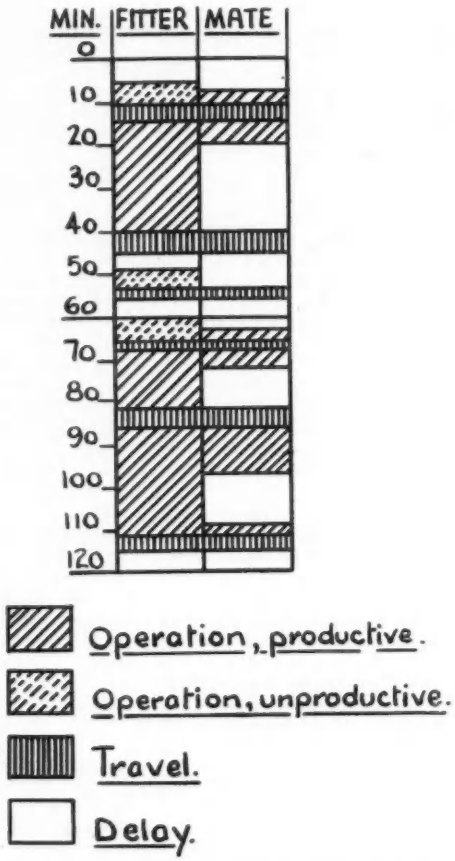


Fig. 1. Process chart: Unplanned operation.

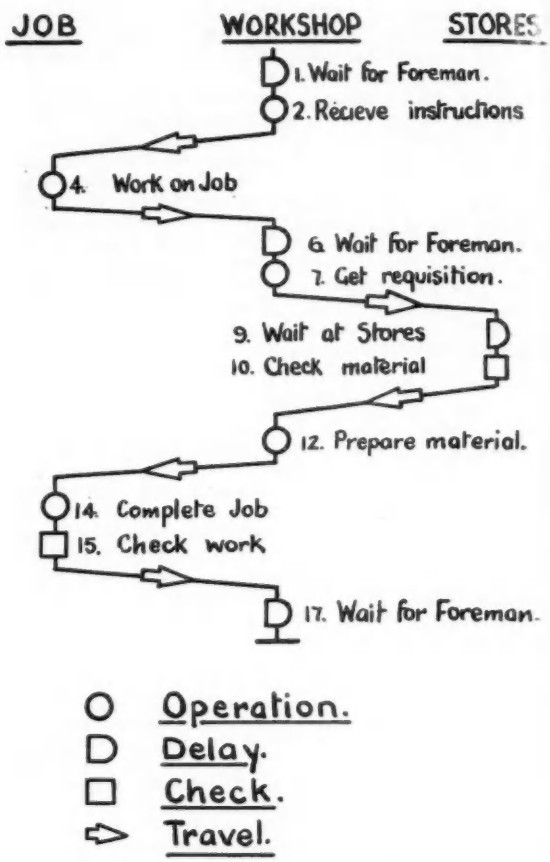


Fig 2. Time study: Unplanned operation.

samples, it is apparent that although the greater proportion of time is spent on the longer jobs, by far the greater number of jobs are of short duration. The 'mode,' or point at which the most frequent grouping occurs is, in fact, two hours. This means that the maintenance men do a considerable number of different jobs in the course of a day, which throws more strain on the organisation than would be the case if all jobs were long and continuous over a period.

To appreciate fully the implications of these facts it will be helpful to follow the course of one of these typical jobs of two hours duration, as carried out by an unplanned organisation of the type described in Table 1. The sequence of operations might be as follows:

1. Fitter waits for foreman.
2. Foreman instructs fitter.
3. Fitter goes to site.
4. Fitter works on job.
5. Fitter returns to workshop.
6. Fitter waits for foreman.
7. Fitter gets requisition for material from foreman.
8. Fitter goes to store.
9. Fitter waits to be served.
10. Fitter receives material and checks it.
11. Fitter returns to workshop.
12. Fitter prepares material.
13. Fitter returns to job.
14. Fitter completes job.
15. Fitter checks work.
16. Fitter returns to workshop.
17. Fitter waits for foreman.
18. Fitter gets instructions for next job.

This sequence is shown diagrammatically on the process chart given in Fig. 1 and a dual-activity time-chart is given in Fig. 2 on which the peregrinations of the fitter's mate are also assessed. It should be pointed out that a time study at this stage is quite superfluous since a glance at Fig. 1 shows the need for plain method study, but some idea of time is useful for comparison. A critical appraisal of Fig. 2 reveals the need to reduce travel and waiting time and an effective way to do this is to remove from the fitter the onus of assessing the job and of estimating and fetching materials. In other words, a functional arrangement is needed and if the same task were undertaken by an organisation of the type described in Table 2, then the process chart might be as in Fig. 3 and the sequence of operations as follows:

1. Fitter waits for foreman's instructions.
2. Fitter receives a number of job cards and arranges them in suitable order.

   He proceeds to work on material for first job. The material has previously been requisitioned by the clerk and delivered by the stores assistant.
3. Fitter goes to job.
4. Fitter completes job.
5. Fitter checks work.
6. Fitter moves on to next convenient job.

As before, a time study can be taken which may be as shown in Fig. 4.

By the application of simple method study it would appear that the total time spent on the job could be reduced from 120 minutes to 75, a saving of 37% and a higher proportion of the fitter's time devoted to productive work than before. Any investigation on the lines of the foregoing is bound to shed the cold light of reason on the modest part played by tradesmen's mates. Tradition, particularly in the engineering industry, has it that each tradesman should have a mate but no agreement, written or tacit, exists to substantiate this contention and there seems to be no reason to indulge it. On the district fitting staff, for example, it is found that an overall

proportion of one mate to two fitters is satisfactory. I.C.I. have investigated this problem and found it possible, by using work study, to establish over a period the ratio of work required of mates to that of fitters and have allocated mates on that basis, disposing of them from a pool controlled by the foreman[9]. There is no doubt that considerable room for economy exists here, given such a pitch of organisation that maintenance operations are planned in advance and personnel requirements precisely known. Work study would be indispensable at such a stage.

Standards Should be Laid Down

Figs. 3 and 4 show great improvement on Figs. 1 and 2 but it does not follow that there would be no room for further improvement. The operation itself has become the most important part of the sequence and the next stage is to examine it to ensure that the fitter is being methodical and following the best practice in executing his task. Efficient management requires that standards should be laid down for every job, whether or not a system of payment by results is in operation[10]. This axiom entails the building up over a long period of data amassed from work study applied to every-day maintenance work. Maintenance work is not, on the whole, repetitive and, therefore, does not lend itself to the simple application of time study. It would be necessary to use the technique of synthesis, the construction of estimated job-times by adding together the estimated times for the elements of which the job is composed. Such practice is common on machine production work and at least one compendium is used on both sides of the Atlantic which claims to present standard time data that are universally applicable to machine production and welding processes[11]. A reference book of this type containing basic time data for maintenance work would have to be compiled for each organisation and daily job estimates derived in terms of standard time by synthesis from this data. The value of work measurement is to be seen when it is considered that while the amount of work produced by labour is measurable, the amount that can be expected to be produced is incalculable, except by the use of work measurement. A more general form of work measurement which seems better fitted for application to maintenance is work sampling. In this, statistical method, similar to that used in public opinion polls or consumer research, is used to determine the incidence of the various elements constituting maintenance work. Action can thus be taken to cause improvement and its effect checked by further observations. The method is ideal for periodic check on the effectiveness of the department. Special training is required to produce competent work studymen and a suitable organisation would be necessary in support of them.

Bonus Incentive

If work measurement were consistently applied to maintenance so that most work was done to specifications which stated the allowed time for each job, then the next logical step would seem to be to institute a bonus incentive scheme. By this means the tradesman would be offered an incentive to adhere to or improve on the allowed job time and the burden of constant supervision, persuasion or coercion is removed from the foreman. It is generally considered that payment by results is not applicable to gasworks practice and least of all to maintenance work, but it is questionable if that view is realistic in current conditions of full employment. The gas industry must compete in the labour market against the wealthier manufacturing industries for both production and skilled personnel and its restriction to flat-rate, negotiated wage systems imposes a handicap on its ability to get and hold high-grade men. If good mechanical and electrical equipment is to be used on gasworks then good maintenance men should be there to look after it. A gas undertaking in an area devoted to the production of vehicles, aircraft, chemicals and other manufactured products finds it difficult to get skilled men when it offers them 4s. 10½d. per hour, while neighbouring factories tempt them with rates varying from 6s. to 8s. per hour with, probably, bonus payments in addition. It is hardly to be wondered at that the works engineer finds himself conceding a tacit guarantee of sufficient overtime to make up wages to a competitive level, although he is well aware that this overtime is grossly unproductive. One way to reduce

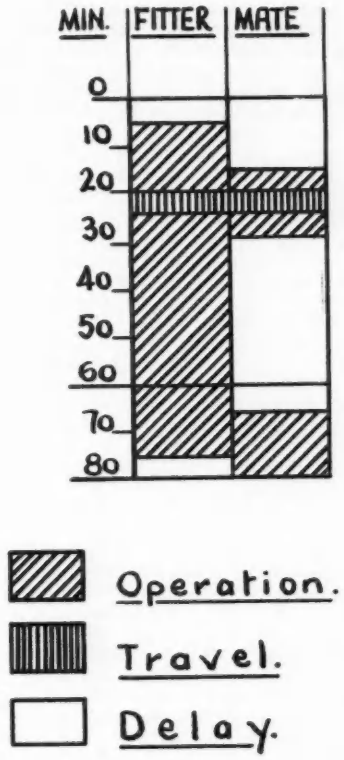


Fig 3. Process chart: Planned operation.

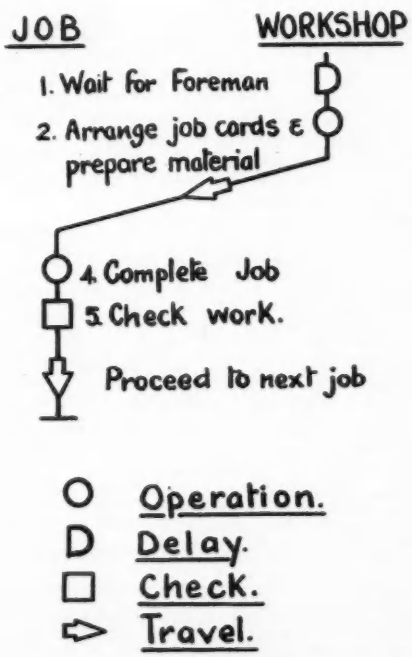


Fig. 4. Time study: Planned operation.

the demand for skilled men in maintenance work would be to adopt the American method of training semi-skilled men to do the scheduled routine tasks, providing the skilled men only for specific work that demands the craftsman. An alternative would be the application of work measurement to maintenance work to establish basic time data from which the work content of jobs is assessed in work units. An incentive scheme is then applied to reward work which betters the standard rating.

There are various ways of applying payment by results, the commonest for production work being the 'straight—proportional' scheme. By this assessment all work done in excess of the normal rate of 60 standard work units per hour is paid for in direct proportion. In this scheme there is no limit, theoretically, to the amount of bonus that can be earned. Where incentives have been applied to maintenance work, however, there has been found a need to safeguard the quality of the work and hence to restrict the extent of the bonus. This need has been covered by the 'variably-geared' scheme, or 'maintenance curve,' [12] by which the maintenance man starts to earn bonus at 45 work units per hour but is limited to a maximum bonus of 50%. Another method of applying bonus incentives to maintenance work that has been applied in factories[13] is a points system by which a number of points is allocated to the maintenance department, based on the capital value of the plant for which it is responsible. Breakdown or other mishaps cause the deduction of points from the total according to a pre-determined scale and at the end of the period the group bonus of the maintenance department is assessed from the total of points remaining. Incentive schemes require a high degree of organisation to ensure success and it must be considered at the outset whether the benefits to be gained justify the cost.

The benefits which can accrue from the application of bonus incentive seem to be considerable.

In the integrated structure presented by the area gas boards it has become natural to consider most things in terms of central organisation, the Division being the usual centripetal force. Maintenance does not lend itself to such centralisation except in certain limited forms, and these would depend on the shape and size of the Division. There are possible advantages in having a central workshop in which the more expensive machine tools could be installed, or specialist processes such as for the building up of shafts or for applying alloy finishes. Something might be said for the existence of a mobile squad for chemical and mechanical descaling, re-tubing of boilers and condensers, gasholder maintenance and other similar duties but such an arrangement could raise awkward problems of effective control. On the other hand, Divisional organisation in a suitable framework might allow the appointment of a technically qualified engineer to co-ordinate the functional requirements of maintenance to the benefit of the system. Finally, there seems no doubt that, while method study is within the scope of works staff, any effective development of work measurement with the establishment of standard time data and the introduction of bonus incentives would have to be dealt with comprehensively at Divisional, if not at Board level.

REFERENCES

[1] Productivity Report on Plant Maintenance, Anglo-American Council on Productivity, 1952.

[2] Preventive Maintenance, W. Morland Fox, Proc. London and Southern Section I.G.E., February, 1953.

[3] Work Study and Preventive Maintenance, T. C. Robinson, Proc. of the Work Study Conference 1953, Assoc. of British Chemical Manufacturers.

[4] Maintenance Engineering of Gasworks Plant, C. H. Thompson, Proc. Northern Junior Gas Assoc., Dec., 1953.

[5] Maintenance of Mechanical Plant, G. A. Wood, Proc. Scottish Junior Gas Assoc., Feb., 1954.

[6] An Inquiry into the Nature and Causes of the Wealth of Nations, Adam Smith, 1786.

[7] Work Study and its Application to the Gas Industry, J. B. Maylam, Proc. London and Southern Section I.G.E., Dec., 1954.

[8] The Application of Work Study in the West Midlands Gas Board, H. B. Bassett and W. J. G. Bryce, Proc. I.G.E., No. 509, May, 1957.

[9] Work Study and Wages Structure, A. H. Merrie, Proc. A.B.C.M. Conference, 1953.

[10] The Purpose and Practice of Motion Study, Anne G. Shaw, Harlequin Press, 1952.

[11] Handbook of Standard Time Data, A. A. Hadden and V. K. Genger, Thames and Hudson.

[12] A Manual of Time and Motion Study, J. W. Hendry, Pitman. A.B.C.M. Conference, 1953.

[13] A Manual of Time and Motion Study, J. W. Hendry, Pitman.

DISCUSSION

Mr. J. L. Ireland, President of the Association, thanked the author for a most interesting paper, and formally opened the discussion.

Mr. Summerson (Luton) said that the frequency of breakdown was not necessarily to be taken as a measure of the efficiency of maintenance; careless operation came into it as well. A yardstick by which to judge one's own maintenance costs, whatever form it took, would be most useful. But no such yardstick would enable one works' costs to be compared with another, simply because no two works were alike. Preventive maintenance of personnel, as well as of plant, should not be overlooked. In addition to pre-entrant medical examination, first aid, safety measures, examination of tar contacts and issues of vitamin pills, annual medical examination of all employees over 40 might be desirable.

Mr. J. H. Holdaway (Watford) said that method studies had been carried out in district fitting and distribution work in the Watford Division with encouraging results, and although the type of work differed from that in gas works, the same principles applied. For example, on the district, work had been planned to reduce fitters' unproductive time and foremen had been relieved of clerical work, thus improving supervision and consumer service. Although he agreed with functionalism as outlined by Mr. Johnston, there was the need to guard against over specialisation which could prove costly. Method study was indispensable but work measurement was essential for comparing different methods, providing adequate control and ascertaining the efficiency of operatives and departments. It would provide a sound basis for incentive schemes and standard costs.

Mr. Johnston agreed with Mr. Holdaway's comments and was pleased to know that work study was being applied to distribution problems.

Mr. W. A. Evetts (Watford) commented that costs given in pence per therm was satisfactory for some items but the costs in £ s. d. were more illustrative in giving a better idea of the actual sums involved. In the industry today men were often left to work very much on their own, and therefore he welcomed work-study as a means of providing more adequate supervision.

Mr. W. J. Spiller (Cambridge) said that at Cambridge a scheme of planned maintenance had been in operation for some years, and this provided almost complete freedom from breakdowns. With regard to maintenance efficiency, manufacturers should provide more correct spare parts which would avoid a considerable amount of machining before the part could be fitted.

Mr. F. Courtney (Ipswich) said that routine maintenance should not be controlled by the production supervisors. Where this was so, much time was lost by the supervisor in switching from one job to another and it was difficult for him to plan his work.

Mr. Johnston agreed, and added that work study measurements were difficult if production staff only were available to carry them out. Often there were too many men under the control of one foreman. No more than seven or eight men should be under one supervisor.

Mr. J. H. Dyde, Deputy Chairman, E.G.B., wound up the discussion and said that work study had been introduced to him when he visited the U.S.A. and he was subsequently responsible for the inclusion of work study methods in the curriculum of the management course at Brooklands. The attitude of mind clearly expressed by many young men to-day was towards work study and the paper represented a stage that was still on a theoretical basis in applying it to maintenance, but the need for its application was evident. It was applied to all progressive manufacturing concerns, and in our industry the elements were there with which to build up a yardstick for work measurement. It was necessary to have men engaged solely on work study, and if administrative costs were increased as a result he was sure that substantial savings would accrue in the operational field. Electronic computers could be useful in aiding work study, and these were being employed by the Board as, for example, in the central billing department at Tottenham.

Since production was being concentrated at a few large works operating on a high load factor, often using fully automatic plant, a high standard of maintenance efficiency was essential.

WORK STUDY:

Three Years' Progress at Edinburgh

Full discussion of the paper by DAVID BEAVIS (Communication No. 529) to the 95th A.G.M. of the Institution of Gas Engineers, an abstract of which was published last week

Mr. Sydney Smith, Chairman of the Scottish Gas Board, opening the discussion, said: 'The three investigations discussed in the paper emphasise the flexibility and versatility of work study as a management technique. The principal objective in each case was quite different from the other two: In the meter-reading and collecting department work study was employed primarily to resolve an industrial relations problem arising from inconsistency of earnings; in the consumer service department the emphasis was on improved service to the consumer, in terms of better and quicker execution of work; and in the main-laying and service-laying department the objective was increased output at reduced cost. In all cases the prime purpose of the assignment was achieved and brought in its train ancillary benefits; but the important point is that in resolving diverse problems in entirely different fields, work study produced completely effective results.

Realistic Standard Costs

'The careful analysis of work implicit in work study is a necessary preliminary to such other modern management techniques as budgetary control and standard costs. Budgets based on past performance are useless without an independent yardstick with which to measure the standard of past performance; and realistic standard costs can only be determined after method improvement and work measurement.

'Work study emphasises the vital importance of the quality of supervision and management; and significant benefits can only be derived from it when managers and supervisors are exercising effective control of staff and workpeople, and directing their activities to specific ends. In particular it is most important that foremen are recognised as the first link in the chain of management, and respected as such by those for whom and to whom they are responsible.

'The need for objective and logical analysis creates and develops intellectual discipline amongst those trained in the technique, and it is beneficial to all they do; but experience in work study should not be confined to a small group with whom it is a full-time pursuit: Men marked for promotion to supervisory and managerial posts will be all the better supervisors and managers for a period spent with the specialists.

'Interchange between line-management and work study staff promotes that collaboration and mutual interest in a common purpose which is so important in the attainment of maximum advantage from the technique. Innate curiosity—an enthusiastic, enquiring mind with the ability to think and the urge to dig for facts—is an essential quality to look for in any person to be employed on this work. Undoubtedly it pays handsome dividends, not only in cash but in the development of a lasting analytical and factual approach to every type of day-to-day problem.

'I might add on a personal note that the vast improvement in consumer service in Edinburgh has conferred an indirect benefit on myself. Board headquarters, divisional offices and Edinburgh district offices are all sited in the city. Up to six months ago, and because headquarters are perhaps too easily accessible and our service in the city and its environs left much to be desired, regular appeals from irate consumers came straight on to my desk; but I am now happy to say that this no longer happens. No doubt Mr. Beavis is just as relieved as I am!

'The three examples quoted in the paper are, of course, confined to the one city; but similar work has been carried out in other places, particularly in Glasgow, with equally encouraging results.

'The Scottish Gas Board first employed management consultants early in 1952 and have continued to do so since that date. You may be interested to learn that the average fees each year have amounted to about £17,000, but the savings derived annually have been many many times that sum.

'We are all aware that investigations of this nature should be the direct responsibility of management; but we are equally aware that, at vesting date and for many years thereafter, managements were overwhelmed with the routine day-to-day problems inherent in the creation of an organisation where none existed. Because of this state of affairs in many places, there was neither the staff available nor the time to get down to specialised problems—hence the need for outside consultants to be engaged on particular assignments; and from my own personal investigation of the results obtained in Scotland from the date of inception, I can say without any reservation that the savings obtained have been very well worth while.

'As part of the complete re-organisation of the Board's administrative structure, which began to take shape in January, 1957, we introduced in Glasgow a small operational research department which operates both independently of and in conjunction with the management consultants. This department has tackled work study problems similar to those discussed in Mr. Beavis' paper, but it has also carried out assignments where other techniques, such as management accounting and statistical sampling, have been involved.

'Probably the ideal set-up would be to have an organisation and methods or work study team in each of our four divisions and, at headquarters, a small operational research team to co-ordinate the divisional activities and to standardise procedures. We are, in fact, moving towards this end. In this way, the operation research team will be free to accept major area assignments of a research nature, while the divisional teams carry out the field work, attend to local projects and maintain existing incentive schemes. As this organisation comes more fully into operation, the need to employ outside consultants will become progressively less.

Magnificent Example

'Call it what you will—operational research, work study or organisation and methods—each in its own way works for the common objective of increased efficiency and reduced costs; and if the pioneer work done by Imperial Chemical Industries Ltd., and the tremendous savings obtained therefrom is taken as a guide, then the gas industry has a magnificent example which it will pay handsomely to follow.

'In conclusion, I should like to make one other point. It is my belief that in the past we have laid too much stress on sales, to the detriment of consumer service. For nearly two years in Scotland the expression sales and service has been out. We now talk about service and sales; and although we have stepped-up our sales effort to a tremendous extent in all directions, including training and publicity, the accent of speech habit and mental approach has been switched.

'I am convinced that we must channel our efforts towards establishing in the minds of our consumers everywhere a reputation for first-class service. In the past, with few exceptions, we have been sadly lacking in this respect. If ever it were urgently necessary to sell gas to the public, as distinct from selling

appliances, that time is now. Efficient, courteous and prompt service will sell more gas than will new replacement appliances; and I am quite certain that the psychological effect on our staff and workpeople of the change of sequence has had a marked influence for the better on the quality of service we now provide.

'Service which is appreciated by the public as an established fact will bring in its train increased appliances sales and increased consumption; but lack of efficient service could, quite simply, put us out of business. I leave the thought with you.'

Mr. G. H. W. Madge, North Thames Gas Board: 'In his summary the author makes an interesting point about the misconception that work study is adaptable only to factory line production. He goes so far as to say that its application is unlimited. He may be right, although I would hesitate to go all the way.

'Of the three branches of the business with which his paper deals, I propose to deal only with ordinary meter reading and prepayment meter collection, and gas fitting and consumer service, respectively.

'In his introduction, the development of the theme "there is always a better way" is most interesting. The statement which struck me with particular force was that above all "a questioning attitude of mind must be instilled into senior management, supervisory staffs and operatives alike."

'While it is practically axiomatic that the questioning mind is the hallmark of senior management, it is probably fair to say that only in this generation has any serious attempt been made to inculcate this mental attitude at lower levels.

'Cross Fertilisation'

'The methods whereby an appreciation of the importance of work study was introduced first in the minds of management and then of supervisors is well worth reading. So is the generous tribute paid to the trade union movement as a whole regarding this subject.

'The arguments for and against the use of management consultants on work study are well expressed, and I like especially the reference to "cross fertilisation." It is reassuring to note that the result of this liaison is a sufficiency of trained and experienced staff to carry on the good work.

'The question of incentive payments for foremen and supervisory staff has clearly received a lot of thought, although the author says that it is too early to hazard a final solution of the problem. Where I am sure we would all agree with him is in his insistence on raising the foreman's status and on treating him as being in the first line of management.

'Now as to a few specific applications of work study. With regard to the reading of ordinary meters and the reading and emptying of prepayment meters, it is noted that a simple payment by results scheme was in operation before the new methods were introduced in January, 1955.

'The methods whereby this ticklish subject was tackled appear to have been very thorough, and especially so from the point of view of making it a combined operation for management and labour.

'There are many similarities between Edinburgh and North Thames practice. First, the elimination of 1d. meters. For a number of years we have sought, successfully, to eliminate the use of coppers, and meters issued to the district since the war have almost exclusively been designed to take silver only. The majority of the meters on the district with alternative 1s. and 1d. slots have been converted, with the consumer's consent, to take 1s. only. Of the new prepayment meters purchased since the war the great majority are in 1s./2s. 6d. and 1s./6d. types. As a result we, like Edinburgh, collect nearly 100% of our money in silver.

'Second, the incentive bonus scheme. We have experimental schemes in operation for both classes of employee.

'The thing that struck me particularly about the gas fitting and consumer service section of the paper was that a great deal of work study, if not of time study, had been undertaken with far reaching results, but in this case it was done without the full co-operation of all the parties concerned.

'The organisation of the Edinburgh area into districts and zones bears some resemblance to North Thames practice. We, too, work in divisions which vary in size up to 350,000 main meters, but 250,000 meters might be taken as a typical figure. In such a division there would be a number of district offices each dealing with 30,000 to 60,000 consumers.

'While we do not adopt the three-day cycle in order to minimise travelling time and so on we do make use of alternate day instead of every day deliveries of appliances and materials in the more dispersed areas.

'On radio communication it is clear that Edinburgh makes very full use of this modern means, apparently with very satisfactory results. In North Thames we have used it since 1948 but mainly for out of hours emergency work.

'On the status of maintenance men I suggest Mr. Beavis puts in a most important paragraph in a few lines, because the responsibility for keeping complicated modern appliances in efficient operation is no small one, and essentially the men should know what they are doing.

'The gas fitting depôt vehicle again is similar to North Thames. I take it the information centre is a divisional section dealing with enquiries for all the districts. From the account which the author has given to us it does appear to be working extremely well, but my personal experience of an organisation on somewhat similar lines was not so satisfactory. When we formed divisions in the Gas Light and Coke Company some 20 years ago an organisation was set up for dealing with consumers' telephoned enquiries and with the allocation of fitting work throughout the division. While this scheme had a good deal of merit we abandoned it some years later because we felt that the various operators were too remote from the job itself; thus a complaint or anxious enquiry, which above all needed personal attention, tended by the very nature of the organisation to be dealt with impersonally.

'Another factor was that in those days the concentration of telephones among our consumers was not high enough to enable the scheme to be worked in the way intended. Of course that factor may have altered in Edinburgh as well as in London in 20 years.

'On the subject of divisional versus local allocation of work experience has confirmed our view that the allocation of work is better done closer to the job, namely, at depôt level.

Incentive Bonus

'The last paragraph of the chapter reports the interesting development that an approach has been received from the operatives requesting the Board to embark on time study with a view to the introduction of an incentive bonus scheme. I do not envy those concerned in the task of devising such a scheme at so late a stage of major re-organisation.

'In his conclusion, evidence of a growing demand from all departments for work study is given by the author. On the face of it some of the activities listed for future investigation do appear to be less difficult than those already undertaken. Would I be wrong in suggesting that this throws an interesting side light on the Scottish character, which believes in "first things first" and scorns to adopt the expedient of dealing first with what is simple and uncontroversial?

'Finally, the author makes a plea for the interchange of information in the industry on the outcome of work study investigations. In the summary at the beginning of his paper he referred to various sources from which he had derived information. I suggest that his plea should not go unanswered and that the more we get together the wiser, if not the merrier, we shall be.'

Mr. J. W. Holdaway, Eastern Gas Board: 'I was particularly interested in Section IV on gasfitting and consumer service, and rather surprised at the conclusion that little increase in productivity could be achieved by the installation of an incentive scheme. Even with good organisation and adequate supervisory staff, the very nature of district fitting and maintenance work precludes continuous supervision and I would suggest that an incentive scheme would ensure the co-operation and backing of the fitting staff in achieving the maximum increase in productivity made possible by the reduction in unproductive time.

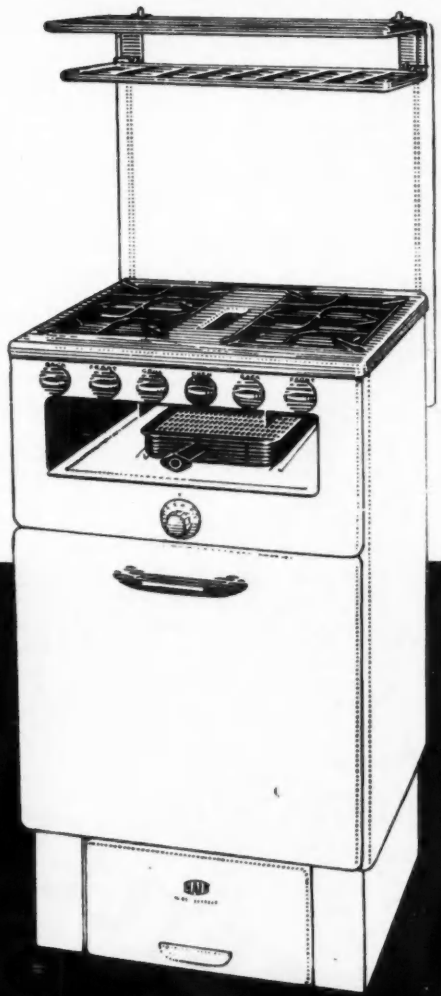
'Furthermore, increased earnings would reduce labour turnover which is a major consideration today. Apart from the advantages of an incentive scheme, work measurement would establish realistic standards, leading to more effective control, standard costs, a

colour! new features!

you will find them in the Main

No.21 Century

- ✳ A modified clear-line hob
- ✳ New style pan supports
- ✳ Speedier heating grill with new pattern frets
- ✳ Increased tension on door closure
- ✳ Spillage tray has guide ribs to locate grill pan
- ✳ Plastic fittings to match hob and plate-rack
- ✳ Oven grid shelves chromium plated
- ✳ New tap brasswork with pre-set simmering position



housewives can choose from these colour finishes . . .

cream and blue
cream and green
or all cream

Note the name-made by MAIN

R & A. MAIN LTD. LONDON & FALKIRK

C138

uniform method of estimating, and a means of gauging efficiency.

'All these things are necessary today, and I hope that Mr. Beavis will decide to accede to the request of his gasfitters for the installation of an incentive scheme based on work measurement, for I am sure that he will be doing the industry a great service, as indeed he already has done in the case of mainlaying, if other boards care to take advantage of the information available.

'The author has not mentioned the delivery of appliances and materials and I should be interested to know how this is organised to fit in with the operation of the fitting staff.

'I support wholeheartedly the plea for interchange of information. In this connection, I recall that Mr. J. B. Maylam presented a paper in 1954 to the London and Southern Section of the I.G.E. entitled "Work Study and its Application to the Gas Industry," in which he outlined a study of meter reading carried out on the Tottenham Division of the Eastern Gas Board. I wonder if his findings were studied before a similar investigation was undertaken at Edinburgh? If not, it seems probable that a great opportunity to save time and money was missed, and such duplication of effort is likely to occur frequently unless the activities of the various boards in this field are co-ordinated.

'Work study is a means of ensuring the most effective use of our resources, and it follows that the principles upon which it is based should be applied to the planning and organisation of its use on a nation-wide scale in the gas industry. Substantial economies and improvements in consumer service are possible, and no time should be lost in this matter if the prosperity of this industry is to continue. A concerted and centrally directed effort is required so that work study can be applied to all aspects of work throughout the gas industry in the shortest possible time.'

Mr. B. G. H. Clegg, Southern Gas Board: 'The author invites us to ask a series of questions about each aspect of our district behaviour—why?—when?—where?—and so on. I have tried this on his first case study, slot collection, and it seems to me that the two main questions are "how?" and "how often?"

Productivity of Collectors

'Mr. Beavis gives an impressive answer to the first question and produces from his slot collectors a 27% increase in productivity for a 9% increase in bonus.

'He does not, however, comment on the equally striking savings to be derived from a proper answer to the question "how often?" The use of the appropriate formula almost always gives the answer "less often." Just "how often" depends on the amount of money in the boxes and the productivity of the collectors.

'The direct cost of collection is—to a first approximation—proportional to the number of collections. The loss of interest on cash in boxes is inversely proportional. It can be shown that the total cost is a minimum when these two items are equal and the formula for optimum frequency (i.e., the number of visits per year) is the square root of the product of cash per box per annum by long term interest rate divided by twice the cost per collection).

'This simple formula can be refined to cover circumstances when collection times, bonus payments and clerical costs vary appreciably with cycle length.

'I applied this to the Edinburgh figures and it suggests an optimum cycle length of about 20 weeks, a further reduction of four in the number of slot collectors and a potential saving of about £1,500 per annum.

'The cost curve is a hyperbola which falls steeply as the cycle lengthens from 13 weeks to 17 weeks. Thereafter it flattens out until the minimum cost is reached. Most of the saving therefore comes from the elimination of one collection per year.

'In my view there is up to £200,000 per annum for the industry in this single fact, and without undue hardship for any customer.

'Section III of Mr. Beavis' paper illustrates the improvement in service and productivity which follows the introduction of central Job Progress.

'It appears, however, that work study was refused by the fitters and I should

OVER 100 YEARS' EXPERIENCE IN THE CONSTRUCTION OF:-

GASHOLDERS, PURIFIERS, CONDENSERS, STEEL TANKS, HANDLING PLANT, MAINS, GENERAL STEEL CONSTRUCTIONAL WORK

SAML. CUTLER & SONS LTD. LONDON

70 VICTORIA STREET, WESTMINSTER, S.W.1

PROVIDENCE IRON WORKS, MILLWALL, E.14

like to suggest to Mr. Beavis two other ways of appraising their work.

'One is quality control, wherein specially chosen supervisors examine random selections of work and complete standard forms designed for statistical analysis. It is in fact a version of an industrial inspection technique.

'The other might be described as quantity control. The times recorded on random samples of job tickets are correlated to the lengths of pipe run to give regression lines such as cooker installation time = 90 minutes + 15 minutes per foot run.

'These lines give unbiased comparisons of the work of different individuals and groups of fitters and standard times for jobs of different lengths. The method can be extended to service laying and can be put on to an electronic computer without much difficulty.

Interchange

'I am encouraged to offer these comments by the author's call for a greater interchange of the results of investigational work. This need becomes the more pressing as more boards take on this type of work and it is to be hoped that Mr. Beavis' plea will lead to some definite action. This indeed would be a worthy conclusion to a very fine paper.'

Mr. H. B. Bassett, West Midlands Gas Board: 'I share the author's view that confidence is the predominant factor in the application of work study. I would, however, add that even with confidence inspired at all levels, management and supervision must accept fully the responsibility thrown upon them by the introduction of work study, particularly in its early stages.

'Management have four main responsibilities: One, to plan the commencement of work study within a section so that the minimum of labour displacement occurs; two, to implement new methods and techniques resulting from method improvement and train personnel before the introduction of incentive schemes; three, to understand fully the problems that will inevitably arise and be competent to deal with them immediately, and four, to operate and maintain new methods and in particular incentive schemes so that there is no loosening of time values by the introduction of even newer techniques.

'I would stress the importance of having a sound knowledge of national and area agreements relating to the wages and conditions of employment of gasworks. We, in the West Midlands, entered into agreements with the trades unions, at Board level, on work study procedures. Under the guidance of the Deputy Chairman, all problems affecting the introduction of work study are dealt with expeditiously.

'My colleagues in the West Midlands would agree with me when I say that the successes we have achieved, particularly on the manufacturing stations, have been largely due to the lead and support given from above and the effective manner in which senior management have accepted their responsibilities and negotiated with the men and their trades union representatives.

'I must disagree with Mr. Beavis when he writes that work study practitioners have done themselves harm with the use of new jargon, i.e., such terms as work units, standard performances, etc. I would submit that if it is the intention of any Board or company to introduce incentive schemes throughout their organisation, then certain fundamental principles must first be agreed upon, and terminology is one. It is my belief that the numerous consultant firms in this country are largely to blame for the inconsistency in terminology and the varying types of incentive schemes in operation. Agreement must be reached on the more comprehensive and detailed problems affecting industrial relations, and standard instructions issued so that both management and work study practitioners are consistent in their approach.

'Above all agreements must be easily and clearly understood. As an example, the work study officers of the Board have for over two years been preparing a manual of standard practice covering time study procedure, documentation, relaxation allowances and terminology. This has been completed and was accepted by the Board subject to the acceptance of the British Standard Report on Work Study Terminology. We can now be confident that whatever job is time studied and an incentive scheme introduced, the fundamental principles will remain the same.

'It is interesting to read that the incentive bonus schemes now in operation in Edinburgh offer only a 25% bonus for a standard performance or a 33⅓% increase in productivity. When one considers that an average operative at present under non-incentive conditions seldom achieves a normal performance, a bonus of 25% appears low in return for a much higher increase in productivity. Mr. Beavis may be fortunate in that he has no automobile industries on his doorstep paying high bonus rates.

'I would agree with all the last speakers on the interchange of information between boards. We sincerely believe that one board can be of great benefit to the others at present.

Change of Policy

'Finally, I would like to ask the author if he could explain more fully Table 1, on p. 13. How much of the increase in productivity by the ordinary readers and the prepayment collectors can be attributed to the incentive scheme and how much to reorganisation and other factors, such as the elimination of copper coin, the change in collecting frequency, the increase in the work of the auxiliaries in relieving prepayment collectors of returning to "no access" calls, and the use of dial cards.

'Without having the full facts available it appears that the larger part of the improvement in productivity has resulted from a change in policy and not from the intensive time studies undertaken. One would expect under the conditions outlined in the paper a far larger increase in productivity or a lower bonus percentage.'

Mr. W. M. Johnston, Eastern Gas Board: 'I come from an area dominated by the manufacture of cars, aircraft, chemicals and other products much in demand. I do not think it would be too sweeping a statement to say that the evident success of these industries is very largely due to the intensive application of work study in its widest sense, to their problems of production, distribution and administration. It is, therefore, with a feeling of encouragement and a sense of relief that I see works study gaining momentum in the gas industry.

'My first point concerns comparative wage rates. In an area such as I have described it is often thought that the successful manufacturers offer extravagantly high wage rates and in so doing queer the pitch in the labour market for the poor but honest gas industry. But is this true? The car plants pay rates which are about 50% higher than ours, but if their organisation encourages their operatives to do twice as much work in a day as our men—and I think that is a reasonable supposition—then it means that we are paying more per unit of work than the car makers.

Scope for Study

'In other words if we could increase our productivity we too could offer attractive wages and still show benefit, as Mr. Beavis has demonstrated. It cannot be disputed, I fear, that the productivity of the gas industry employee is low compared with that of his fellows in the factories but, after all, a gas undertaking is a factory within the meaning of the Act, and I feel we should strive to attain the level of the most efficient factories by using the methods they have proved successful. Work study is one of them.

'Secondly, I express my regret that the works have been left to the last by the work study teams. Some modest exercises in method study in Luton works have shown that there is much scope for work study on gasworks, and I suggest that the maintenance department provides the most fruitful field for action. It presents problems similar to those tackled by Mr. Beavis in consumer service. For example, I think it would be safe to generalise and say that in the traditional maintenance organisation up to 20% of the time is taken up in the peripatetic occupation of shuttling between workshop and job, job and stores, and so on.

'When further allowance is made for delays, unavoidable or otherwise, there is comparatively little time left for productive effort. There is room here for the work study approach, and ample precedent has been established by I.C.I. and other firms. I note that works maintenance and process plants are listed for attention by the Edinburgh work study team, and I hope we shall be given a report of the results in due course.

'My question is about work measurement. Mr. Beavis commented on the reluctance of operatives to be subjected to the scrutiny of the stop watch, and

I imagine that this reluctance will be general throughout our industry, which has no tradition of rating. There is, however, one method of obtaining a picture of the working of a department or group which is effective, if less detailed than that given by the stop watch. This method is work sampling, in which random observations are made of the actions of the operators to establish the incidence of the relevant elements. I should like to ask Mr. Beavis if this method was used in the course of the studies at Edinburgh and if so, in what way and with what success?

'In conclusion, I venture to hope that there will come into being a gas industry central work study department, similar to that of I.C.I., which would, to quote Mr. Beavis, "stimulate by cross-fertilisation the rate of growth of knowledge."'

Mr. L. C. S. Poulter, North Thames Gas Board: 'It seems, from the speakers who have taken part in the discussion, that hardly any board has not given close attention to this problem. Any employer of labour, particularly in these times of high wages, must consider just how he is employing that labour.

'Two very good points have been made: first, by Mr. Sydney Smith, that sales stem from service. That never has been more true than now, and with the trend of things and the sort of appliances which are coming on to the market I think it is even more likely to be true in the future, so I think he is quite right to change the emphasis in the way he has explained.

'The next point—and I am not in a position to speak for my Board, that would be improper, but I do something which I think Mr. Beavis would rather like, namely that in the work study a vast team is not brought in. Rather a stroke is bought in and to that stroke we attach people who have experience at managerial level. I think that is a very good way of getting the support of the employees.

Speed Determination

'Very little has been said about this, but I think it is very clearly brought out here that it is not a question of how little one should do work study but how fast, and I suggest the speed is determined by the employees. Their reaction varies from place to place. Where I am they are pretty broad-minded, but even so they do not like change, and above all they do not like change for the sake of change. I think it will be possible to get it home to them much quicker and better if one has a team of which they know the members.'

Mr. D. D. Melvin, Edinburgh: 'It will be apparent that work study is not just one but several techniques, each of which has been carefully developed and polished over a number of years, so that at the present time it is possible to select fairly quickly those which will give the most beneficial results in any given situation. Time study alone is not work study, neither is it motion study; they are simply particular tools in the kit of the work study specialist. It is only when one realises that a fundamental approach to most of the work study techniques is to break down any given process into a number of small components which can be examined minutely by certain special yet simple standards that one begins to see the versatility of the technique.

'In the area of the Scottish Gas Board the work of introducing work study was carried out by a firm of consultants. You may ask, why not do it ourselves from the beginning? In this field, however, the consultants have already made most of the possible mistakes for other clients and therefore come to us armed with many years' experience. When this sort of work is to be carried out on a large scale it is not enough simply to buy one or two works study men and to set them loose in the organisation. They have got to be supervised, guided and encouraged like anybody else.

Strong Selling Point

'The annual rate of direct labour savings associated with increase in productivity and output is usually the strong selling point in any particular scheme presented to management but the basis of presentation requires careful and critical study and appreciation. Where direct labour savings are quoted, usually these are based on the new rate of output. If an increased rate of operation is required and funds are available for a planned programme of essential work so well and good. This is so in our Edinburgh Division so far as the mainlaying programme is concerned and the labour savings will accrue. On the other hand when planned operations are limited by capital or revenue expenditure limits, which they often are these days, then the target saving must be modified. In work like meter reading where the total number of meters to be read is more or less fixed the increased output per man entails the redeployment of surplus manpower to useful work elsewhere in the organisation unless the turnover or wastage rate is high.

'One apprehensive note which was struck in our minds was the fear that because of the speed up of the work by the promise of increased pay packets, quality might suffer and the work be skimped, no matter how good and conscientious were the men concerned. This may seem to be particularly true of mainlaying operations where tracks have to be prepared carefully and joints made to last in a sound condition hidden from human eye for a long number of years.

Quality Checks

'But there is a question which is a corollary to these doubts; is supervision of this type of work adequate? In most cases we find that the simple answer to any doubts about the quality of work under incentive bonus systems is to apply quality checks of the right sort and the acceptable standard of quality must be defined and adhered to. These checks not only ensure effective operation of the work under bonus systems but also reveal other faults which may have arisen in any case.

'We must bear in mind, however, the words of Mr. R. M. Currie, the foremost expert on work study, when he points out that "work study cannot be a substitute for good management, and its efficiency will depend about 60% on the support of that management, 30% on the goodwill of the workers and only 10% on the actual content of the techniques themselves."

'One cannot stress too strongly, as the author has done, the necessity for cultivating that attitude of mind in management, in supervisors, and in employees so necessary to the success of each particular application. The suggested interchange of information within the industry is highly desirable and there seems a very strong case for some sort of clearing house to be set up. At the same time the experience and applications described in the paper seem to have been successful in large measure by the way in which a step by step approach has been made to each group of employees concerned, and it may be undesirable to short circuit this procedure.'

COKE SALES DROP IN N.W.G.B. AREA

SALES of coke by the North Western Gas Board for the financial year ended March 31, 1958, were 1,370,750 tons—9.8% down on last year's sales. Inland sales at 1,279,122 tons were 5.2% down and exports at 91,628 tons 46% down.

Inland coke sales during the five-week period ended March 31 reversed the downward trend at 180,953 tons, an increase of 23.3% over the sales for the same period last year—due probably to the cold weather during the month. Exports for March at 5,511 tons, however, continued the trend and were down by 62.2% on the amount exported during March last year. Total sales for the month were up by 15.5%.

The experience of dropped coke sales during 1957-58 has been shared by the gas industry as a whole, which in common with the coal industry, has found public demand less than output largely because of milder weather but also because of diminished industrial demand both at home and abroad.

Sales of 'Phimax' during March in the Manchester and the Central Lancashire areas, where this new solid smokeless fuel is marketed, amounted to 5,510 tons as against last year's sales of 4,175 tons. Sales of the new fuel for the year, ended March 31, 1958, amounted to 28,080 tons.

Shipments Stepped Up

The Scottish Gas Board is to ship coal from Durham and Northumberland to Peterhead, Fraserburgh, and Burghead, to augment shipments already being made to Inverness and Aberdeen.